THE MICRO WORKS

8OC DISASSEMBLER

OWNER'S MANUAL

P.O. BOX 1110 DEL MAR, CA 92014 714-942-2400

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80C DISASSEMBLER FOR THE COLOR COMPUTER

WARRANTY STATEMENT

80C Disassembler is provided as is without warranty. Reasonable care has been taken to insure that the program operates as described in this manual. If you find a discrepancy in which it does not operate as such, please notify us. We will attempt to correct any errors brought to our attention, however, we make no guarantee to do so.

THE COLOR COMPUTER DISASSEMBLER FROM THE MICRO WORKS

The Color Computer Disassembler is a program which is designed to run in the Radio Shack Color Computer and to provide readable listings of machine-language programs in the memory of the computer. These listings may be displayed on the computer's screen or sent to a printer, and may be in any of several formats. The code to be disassembled may be resident in the computer or may be any 6809 code which is loaded into the computer's memory. This document describes the operation of the disassembler, and should enable you to quickly begin use of the program as well as allowing you later to understand and fully use the many options available.

This program is on a cassette tape which should be loaded with the CLOADM command. It will load starting at location $0600 and will wipe out any BASIC program that is there. BASIC should not be run after the tape is loaded; type EXEC to run the disassembler.

You will be prompted for a series of parameters, starting with "START ADDRESS". To get started, simply type a carriage return ("ENTER" key) in response to every question. In this program, all answers may be "defaulted" with a carriage return. After the last question, there will be a pause (for pass 1, the symbol table being built). When all the questions are defaulted, the entire BASIC ROM will be disassembled and pass 1 will take about 45 seconds. Then the listing will start.

To control the speed of the listing, the following keys may be used:

- Space bar will put the listing in single step mode; another key will put it back.
- Shift-@ will stop the listing as it does in BASIC.
- "S" will speed up and slow down the listing.
- BREAK key will allow the listing to be restarted at another address.

The question "RESTART WHERE?" will appear at the end of the listing or when BREAK is pressed. If it is defaulted (return is pressed) the program will restart from the beginning. Some of the questions which the program asks pertain to formatting and will be used often; some pertain to exactly what should be disassembled and will depend upon your application; still others are only for special cases and you may never need to answer them.

For all of your responses, your options are as follows:

(1) You may default by simply pressing RETURN. All questions may be defaulted. When in doubt as to the meaning of a question, just press RETURN.

(2) Addresses may be entered as a string of hex digits. If more than four digits are entered, the last four are used. Normal editing characters such as backspace are allowed.

(3) Addresses may be entered in base ten by prefacing them with a period (eg. ".10" is the same as "A".)

(4) Yes / No questions may be answered with "Y" or "YES" or "N" or "NO". Default (RETURN) is the same as NO.

(5) The question "AREA OPTIONS" has a different format and is

discussed below. When in doubt, default.

(6) You may press the BREAK key. This will restart the program at the beginning.

The first question asks for an address at which to start disassembling, and the next for an address at which to stop. If these are both defaulted, you will be asked later if you want to default the entire definition of what to disassemble (see below).

The next question asks for an offset to where the code can be found. This is only used if some code has been copied to an address where it does not ordinarily run, and is usually defaulted (which is the same as a zero).

Next is the symbol table start and end address. This specifies some unused area of RAM which the program may use freely. The start and end default respectively to just after the end of the disassembler and 50 bytes below the stack. They only need to be entered if these values will interfere with a program being disassembled.

Next is the area options, so we had best digress a little into the idea behind them. A program is generally made up of machine code, data tables, address tables, and so forth, all intermixed at the discretion of whoever wrote the program. Since there is no reason why data can't look like code, it is not possible for any disassembler to automatically figure out the boundaries of these areas. The "AREA OPTIONS" in this disassembler allow you to specify how to treat each area within the block being disassembled.

Disassembly is normally a two-step process. First, you disassemble the entire block treating everything as code. Certain blocks will stand out as being data, and the ASCII column on the output will help to identify text strings. You note a list of these areas and then enter them to make a new listing which is much "cleaner". If a perfect listing is desired, the new listing is studied at length until a complete list of areas is discovered, and the disassembler is run yet again.

The area types allowed by this program are as follows:

P - program area (machine code)
D - data area (FCB mnemonics)
A - address area (FDB mnemonics)
S - text string area (FCC mnemonics)
V - variable area (RMB mnemonics - contents of memory ignored)
T - table area (alternating FDB and FCB)
E - end of last area

To enter an area, type the letter of the area type, a space, and an address. For example, if there is data at addresses 4567 through 4568, type:

```
D 4567          (data area starts at 4567)
P 4569          (program area resumes at 4569, one byte past the
                 last data byte)
```

After the last option is entered, simply press RETURN.

The actual effect of entering a starting address (in answer to the first question) is to have that address entered in the area table as a "P" area. If that address is later specified as another type (or if any area is respecified) the new definition simply takes the place of the old one. The effect of entering an ending address (in answer to the second question) is to have that entered as an "E" area. When a RETURN is entered in response to the AREA OPTION question (whether or not it is the first time it was asked) the program checks that there are at least two boundaries specified, and if not the question is repeated.

If nothing has been entered, however, you are given a choice of copying the last set of areas used. The question is phrased so that a NO or default answer will copy in the previous set of areas. This table may then be added to. This is useful in building a set of areas, and restarting the program whenever a new area is discovered. If this option is used when the program is first loaded, however, the default set of areas will be set to those corresponding to the Level 1 BASIC interpreter ROM.

The remaining questions deal with the format of the output. You may select the full output mode, the scan format, or the default format. The full output takes two lines on the screen for each line of generated source, but contains the complete output with reference and cross reference addresses. If an 80-column printer is available, it is recommended that this format be used. The scan format contains the ASCII column and complete data columns at the expense of labels, and is useful for determining where the various data and code areas are. The default output mode gives only the first two bytes of the hex value in order to make room for labels. Both the scan and default format listings will fit in one line across the screen or across a 32-column printer, and so will be half as long as the full listing.

The next question is whether or not to send the output to the printer. Any printer that works with BASIC will work with the disassembler. If the printer is requested, then you are asked if it is 80 columns. Actually anything wider that 64 columns will work in 80-column mode. For a narrow printer, the next question is: "NO CR ON COL 32?". This is for the benefit of those printers which automatically produce a carriage return / line feed on column 32 and for which the program-generated carriage return would be redundant. If you type "NO" (or default), and the listing contains unwanted blank lines, try typing "YES" to this question next time.

The program now executes Pass 1. This will take anywhere from no apparent time on a small disassembly to 45 seconds on the entire BASIC ROM. When Pass 1 is complete, Pass 2 starts and the listing will be produced.

When Pass 2 finishes, or is stopped by the BREAK key, it asks where to restart. Any address may be given within the area covered by Pass 1. If an address is given beyond the end of Pass 1 the question will be repeated. If it is before Pass 1, however, the disassembler will not object and will disassemble using the last area type it was left in. This last feature allows the disassembler to be used like

a one pass disassembler by specifying a short Pass 1 at the top of memory, then restarting wherever you want to disassemble. If you do not give an address to the restart question, the whole program is restarted.

The cross reference produced by the full format listing is used to find every explicit reference to any address. It is used as follows: Find the address of the label in question. Look it up in the table at the end, which is sorted by address. (Labels within the program are listed first, and externals listed separately.) The number given after the address in that table is the address of the last reference to that label. Now look at that reference. A number given in the cross-reference column at that line will point to the next prior reference, and so on. Four dots in the cross-reference column indicates that that is the first reference to that address, and is the end of the chain. A blank in the cross-reference column indicates that that is the only reference to an address and saves looking up the address in the table at the end.

While the listing is being generated, numeric keys may be pressed to change listing modes. 1, 2, or 3 may be pressed to change into Full, Scan, and Default modes respectively. 4, 5, and 6 may be pressed to change into three more modes which are seldom used: Source Only, Reference, and XReference; these are all one-line modes which sacrifice various fields in order to include others within the limited width of the screen.

Sometimes there is a reference to a label that is not on the first byte of an instruction. This happens often when disassembling a program where the data and variable areas are not known. It also occurs in perfectly disassembled listings when the programmer used such dirty tricks as using a Compare X Immediate opcode as "Skip over two bytes" and following it with a two byte instruction. There are two ways this disassembler deals with this. To increase readability, it normally will set the program counter back so as to disassemble the instruction at the label. This method, though nice, is not correct in that the listing produced will not then reassemble to the original code, and for this reason the "Source Only" format causes it to print labels of the form:

```
   L1234 EQU *-1
```

In scan mode, where such backward referenced labels are mostly due to lack of area specifications, they will also print as EQUs.

APPENDIX I: EXAMPLES OF THE DISASSEMBLER'S OUTPUT

THE FOLLOWING ARE EXAMPLES OF THE OUTPUT OF THE DISASSEMBLER. THE THREE FORMATS ARE SHOWN. THE FULL FORMAT, WHICH TAKES DOUBLE LINES ON A 32-COLUMN PRINTER, IS SHOWN PRINTED ON BOTH A 32-COLUMN PRINTER AND AN 80-COLUMN PRINTER.

IN ADDITION, AN EXAMPLE IS GIVEN OF THE HEADER OUTPUT WHICH IS PRINTED AT THE START OF LISTINGS. THIS INCLUDES NAM, ORG, AND EQU STATEMENTS WHICH WOULD ALLOW THE DISASSEMBLY TO BE REASSEMBLED.

```
        NAM   DISASM
        ORG   $3000
X0000   EQU   $0000
X3119   EQU   $3119
X313C   EQU   $313C
X3141   EQU   $3141
X31C1   EQU   $31C1
X33DC   EQU   $33DC
X3C2A   EQU   $3C2A
X3E5A   EQU   $3E5A
X3EF5   EQU   $3EF5
X3EF9   EQU   $3EF9
X3F0A   EQU   $3F0A
X3F1C   EQU   $3F1C
X3F35   EQU   $3F35
X3F36   EQU   $3F36
X4484   EQU   $4484
XCD00   EQU   $CD00
XD286   EQU   $D286
XD2B5   EQU   $D2B5
XD2C4   EQU   $D2C4
XD2C7   EQU   $D2C7
XD30F   EQU   $D30F
XD312   EQU   $D312
```

HEADER WHICH ALLOWS REASSEMBLY OF OUTPUT

EXTERNAL EQUATES

FULL FORMAT, 80-COLUMN PRINTER

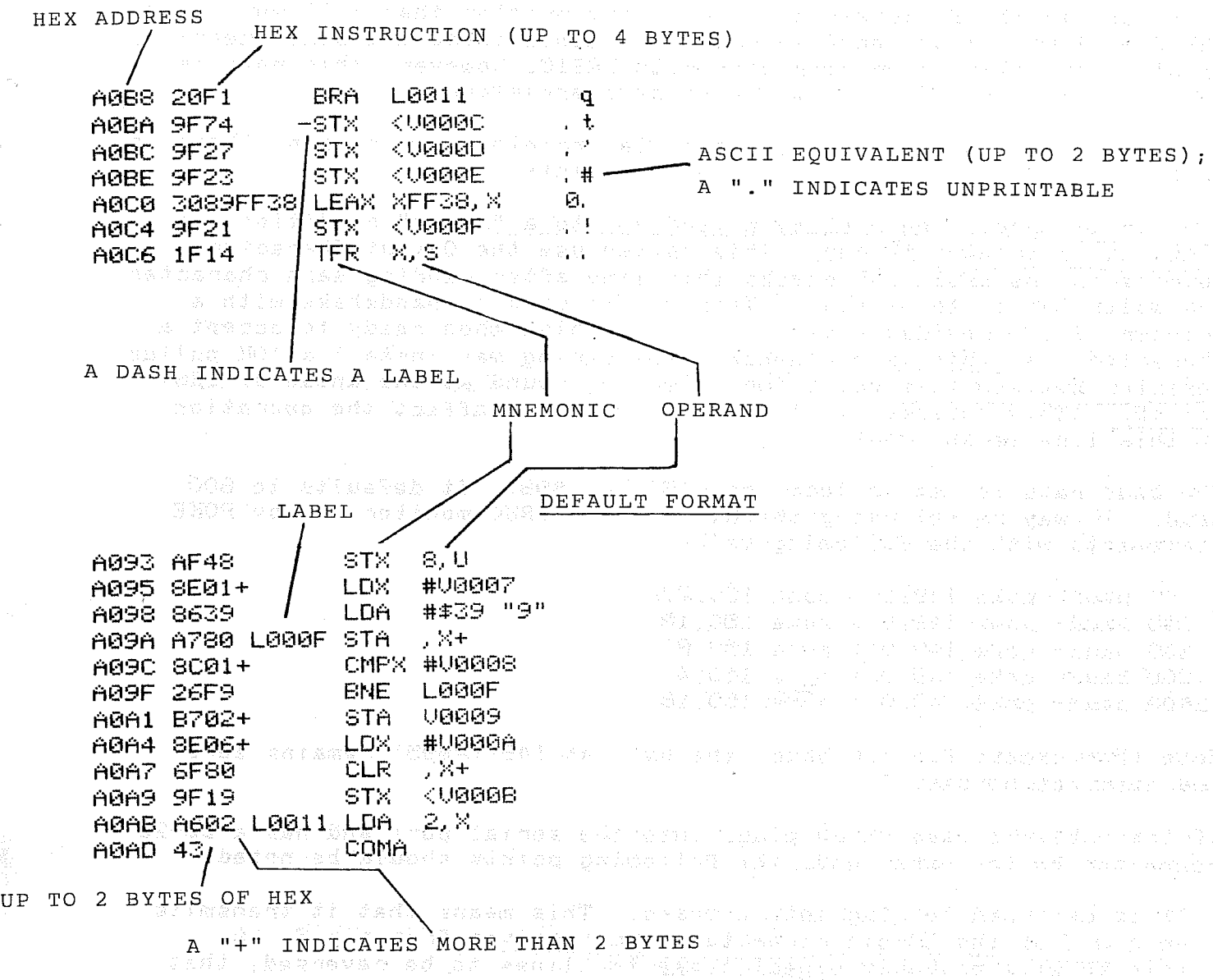
```
302C   BDD2C7   D2C7      =RG          JSR   XD2C7
302F   2502     3033      %.           BLO   L0004
3031   4F                 O            CLRA
3032   39                 9            RTS
3033   BDD2C4   D2C4      =RD    L0004 JSR   XD2C4
3036   4D                 M            TSTA
3037   39                 9            RTS
3038   01                 .            FCB   $01 <<
3039   2C10     304B      ,.           BGE   L0005
303A                                L0000 EQU   *-1
303B   FF3F36   3F36      .?6          STU   X3F36
303E   BD3C2A   3C2A      =<*          JSR   X3C2A
3041   53                 S            COMB
3042   4F                 O            CLRA
3043   55                 U            FCB   $55 <<
3044   52                 R            FCB   $52 <<
3045   43                 C            COMA
```

UN-DISASSEMBLABLE BYTES ARE FLAGGED WITH "<<"

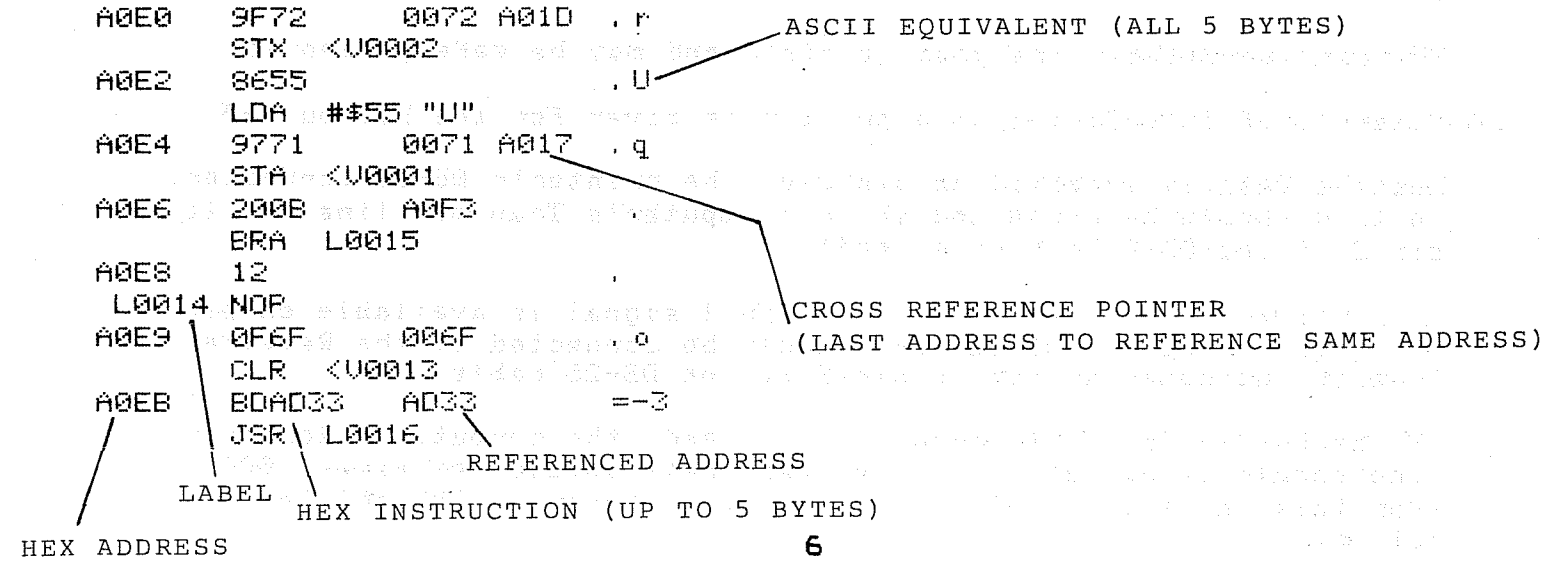
A LABEL ON THE SECOND BYTE OF INSTRUCTION

TEXT STRINGS SHOW UP IN THE ASCII COLUMN

"SCAN" FORMAT



FULL FORMAT, NARROW PRINTER



APPENDIX II: A NOTE ON INTERFACING A PRINTER TO THE COLOR COMPUTER

As stated in the Disassembler manual, any printer that will work with BASIC will work with the Disassembler. Since there are some questions involved in making a printer work with BASIC, however, this note is included in hopes that we may be of some assistance.

All references to printers are to serial printers; at present there is no easy way to interface to a parallel printer.

The serial input line must be pulled up (to a "break" condition) in order for a printer to run. This is because the Output Character routine in the BASIC ROM checks this line after sending each character and waits for it to be high. This may be used to handshake with a printer if it provides a signal which is high when ready to accept a character. If this is not needed, the daring may install a 10K pullup resistor between this point (which may be found at the anode of CR6) and +5. (This resistor is large enough not to affect the operation of this line as an input.)

The baud rate is set in locations $95 and $96. It defaults to 600 baud. It may be set using the Micro Works CBUG monitor, or by POKE statements with the following values:

```
 110 baud- poke 149,1 : poke 150,202
 300 baud- poke 149,0 : poke 150,180
 600 baud- poke 149,0 : poke 150,87
1200 baud- poke 149,0 : poke 150,41
2400 baud- poke 149,0 : poke 150,18
```

Note that except for 110 baud, the byte at 149 (=$95) remains zero and need not be set.

If the cable is used which plugs into the serial port and has a DB-25 connector on the other end, the following points should be noted:

It is designed to plug into a modem. This means that it transmits on pin 2 of the 25-pin connector, and receives from pin 3. A printer will probably expect these two lines to be reversed; that is, the printer will listen on pin 3.

Ground is on pin 7 as usual.

The carrier-detect line goes to pin 8 and may be safely ignored.

An example of interfacing to a printer is given for the Malibu 165:

Receive Data is expected on pin 3 of the printer's DB-25 connector, so this should be connected to the computer's Transmit line (or to pin 2 if the DB-25 cable is used).

A positive-true Printer Buffer Not Full signal is available on pin 20 of the printer's DB-25, and should be connected to the Receive line on the computer (or to pin 3 of the DB-25 cable).

If the Buffer Not Full signal is not used, the computer's Receive line should be pulled up and the baud rate should not exceed 600 (for this particular printer) so as not to overrun the printer's buffer.

APPENDIX III

MEMORY MAP OF THE COLOR COMPUTER:

```
0000-03FF  RAM USED BY BASIC INTERPRETER
0400-05FF  VIDEO DISPLAY (MAY BE MOVED)
0600-0FFF  RAM FOR USER PROGRAM
1000-3FFF  ADDITIONAL RAM IN 16K SYSTEM
4000-7FFF  NOT USED
8000-9FFF  EXPANSION ROM SLOT
A000-BFFF  BASIC INTERPRETER ROM
C000-FEFF  AVAILABLE TO CARTRIDGES
FF00-FFFF  I/O AND CONTROL; SEE BELOW
```

MEMORY MAP OF I/O AND CONTROL AREA:

```
FF00-FF1F  PIA 1 (ONLY 4 BYTES USED)
FF20-FF3F  PIA 2 (ONLY 4 BYTES USED)
FF40-FF5F  UNUSED (AVAILABLE TO CARTRIDGES FOR I/O)
FF60-FFBF  NOT USED
FFC0-FFDF  6883 REGISTERS (SEE BELOW)
FFE0-FFEF  NOT USED
FFF0-FFFF  RESTART VECTORS (ECHO FROM BFF0)
```

PIA 1 CONNECTIONS:

```
FF00  BITS 0-6  KEYBOARD ROW INPUT
      BIT  7    JOYSTICK COMPARISON INPUT
      BITS 0-1  ALSO CONNECTED TO JOYSTICK SWITCHES

FF01  PIA CONTROL REGISTER A
      CA1 IS 63.5 uSEC IRQ  <--
      CA2 IS OUTPUT TO LSB OF MUX

FF02  BITS 0-7  KEYBOARD COLUMN OUTPUT

FF03  PIA CONTROL REGISTER B
      CB1 IS 16.7 mSEC IRQ  <--
      CB2 IS OUTPUT TO MSB OF MUX
```

PIA 2 CONNECTIONS:

```
FF20  BIT  0    CASSETTE DATA INPUT
      BIT  1    RS232 DATA OUTPUT
      BITS 2-7  OUTPUT TO DAC

FF21  PIA CONTROL REGISTER A
      CA1 IS RS232 CARRIER DETECT FIRQ
      CA2 CASSETTE MOTOR CONTROL OUTPUT

FF22  BIT  0    RS232 DATA INPUT
      BIT  1    SINGLE BIT SOUND
      BIT  2    RAM SIZE JUMPER INPUT
      BIT  3    VDG CONTROL - "CSS"
      BIT  4    VDG CONTROL - "GM0" & "I/E"
      BIT  5    VDG CONTROL - "GM1"
      BIT  6    VDG CONTROL - "GM2"
      BIT  7    VDG CONTROL - "A/G"
```

FF23 PIA CONTROL REGISTER B
      CB1 IS CARTRIDGE FIRQ
      CB2 IS SOUND ENABLE OUTPUT

NOTE ON USING PIA CONTROL REGISTERS -
  WHEN WRITING TO A CONTROL REGISTER, ALWAYS SET BITS 2, 4, AND 5.
  SET BIT 0 TO ENABLE AN INTERRUPT FROM CA1 (OR CB1).
  SET BIT 1 TO LOOK FOR A RISING EDGE ON CA1 (OR CB1); OTHERWISE
     THE PIA WILL LOOK FOR A FALLING EDGE.
  SET BIT 3 TO TURN ON THE OUTPUT (CA2 OR CB2).
  WHEN READING, BIT 7 WILL BE SET IF AN EDGE HAS BEEN FOUND ON
     CA1 (OR CB1), AND WILL STAY SET UNTIL A READ IS DONE OF THE
     DATA REGISTER (THE BYTE BEFORE THE CONTROL REGISTER).

  EXAMPLES:

```
     LDA #$34     NO INTERRUPT, FALLING EDGE, CA2 OFF
     STA $FF21    CASSETTE MOTOR OFF
     LDA $FF21    GET CA1 FLAG
     BPL NERF     BRANCH UNLESS CARRIER DETECT HAS GONE HIGH TO LOW
     LDA $FF20    RESET CA1 TO LOOK FOR NEXT TRANSITION
```

THE DUAL 4-1 ANALOG MUX:

THE TWO OUTPUTS CA2 AND CB2 FROM PIA 1 ARE USED TO CONTROL THE STATE OF AN ANALOG MULTIPLEXOR. ONE HALF OF THIS MUX DETERMINES WHICH SIGNAL GOES TO THE TELEVISION SOUND OUTPUT, AND THE OTHER HALF SELECTS WHICH JOYSTICK (AND WHETHER VERTICAL OR HORIZONTAL) IS TO BE COMPARED TO THE OUTPUT OF THE DAC.

FF01	FF03	SOUND OUT	JOYSTICK IN
34	34	6-BIT DAC	RIGHT HORIZONTAL
3C	34	FROM CASSETTE	RIGHT VERTICAL
34	3C	FROM CARTRIDGE	LEFT HORIZONTAL
3C	3C	NONE	LEFT VERTICAL

NOTE THAT THERE WILL BE NO SOUND OUT ANYTIME CB2 OF PIA2 (FF23 BIT 3) IS LOW. THIS IS THE SOUND ENABLE BIT. IT DOES NOT AFFECT THE JOYSTICK INPUTS.

LIST OF RESTART VECTORS:

```
FFF0  NOT USED
FFF2  SOFTWARE INT #3
FFF4  SOFTWARE INT #2
FFF6  FIRQ
FFF8  IRQ
FFFA  SOFTWARE INT #1
FFFC  NONMASKABLE INT
FFFE  RESET
```

REGISTERS IN THE 6883:

THESE REGISTERS ARE SET ONE BIT AT A TIME. A WRITE TO AN ODD ADDRESS SETS A BIT, AND A WRITE TO AN EVEN ADDRESS CLEARS A BIT. THE DATA WRITTEN IS IMMATERIAL. THE LOWEST ADDRESS IN A GROUP AFFECTS THE LEAST SIGNIFICANT BIT OF THE REGISTER, AND THE HIGHEST ADDRESS AFFECTS THE MOST SIGNIFICANT BIT.

FFC0-FFC5	VIDEO DISPLAY MODE (NORMALLY 000)
FFC6-FFD3	ADDRESS OF START OF DISPLAY (BY 1/2 K INCREMENTS)
FFD4-FFD5	RAM BANK (NOT USED)
FFD6-FFD9	MPU SPEED (NORMALLY 00 FOR 0.9 MHz)
FFDA-FFDD	MEMORY SIZE
FFDE-FFDF	MEMORY MAP TYPE (0 FOR ROM-BASED SYSTEM)

VIDEO DISPLAY GRAPHICS MODES:

6883 MODE BITS -->						V2	V1	V0
6847 CONTROL BITS -->	G/A	GM2	GM1	GM0	CSS			
INTERNAL ALPHANUMERICS	0	X	X	0	X	0	0	0
EXTERNAL ALPHANUMERICS	0	X	X	1	X	0	0	0
SEMIGRAPHICS - 4	0	X	X	0	X	0	0	0
SEMIGRAPHICS - 6	0	X	X	1	X	0	0	0
SEMIGRAPHICS - 8	0	X	X	0	X	0	1	0
SEMIGRAPHICS - 12	0	X	X	0	X	1	0	0
SEMIGRAPHICS - 24	0	X	X	0	X	1	1	0
FULL GRAPHICS - 1C	1	0	0	0	X	0	0	1
FULL GRAPHICS - 1R	1	0	0	1	X	0	0	1
FULL GRAPHICS - 2C	1	0	1	0	X	0	1	0
FULL GRAPHICS - 2R	1	0	1	1	X	0	1	1
FULL GRAPHICS - 3C	1	1	0	0	X	1	0	0
FULL GRAPHICS - 3R	1	1	0	1	X	1	0	1
FULL GRAPHICS - 6C	1	1	1	0	X	1	1	0
FULL GRAPHICS - 6R	1	1	1	1	X	1	1	0

APPENDIX IV

THE FOLLOWING IS A LIST CONTAINING SOME INTERESTING ADDRESSES IN THE BASIC ROM. IT IS INTENDED TO AID IN THE UNDERSTANDING OF DISASSEMBLY LISTINGS. IT IS NOT IN ANY WAY COMPLETE AND NO REPRESENTATIONS ARE MADE AS TO ACCURACY OR APPLICABILITY. THE ADDRESSES SHOWN MAY INDICATE THE BEGINNING OF A GENERAL AREA AS OPPOSED TO ACTUAL ENTRY POINTS OF SUBROUTINES. CARE SHOULD BE EXERCISED IN THE UTILIZATION OF INFORMATION IN THIS LIST.

A000 ADDRESS OF CHECK KEYBOARD
A002 ADDRESS OF CHARACTER OUT
A004 ADDRESS OF CASSETTE READ ON
A006 ADDRESS OF BLOCK IN
A008 ADDRESS OF BLOCK OUT
A00A ADDRESS OF JOYSTICK IN
A00C ADDRESS OF HEADER OUT
A00E SECONDARY RESET
A027 PRIMARY RESET
A06E HARDSTART (AFTER RESET)
A0E8 SOFTSTART (AFTER RESET)
A0F6 FIRQ ENTRY (ROM PACK CHECK)
A10D START OF AREA DOWNLOADED TO RAM AT $8F
A129 START OF AREA DOWNLOADED TO RAM AT $10C
A170 INPUT CHARACTER, BIT 7 CLEAR
A176 INPUT CHARACTER
A199 BLINK CURSOR COLOR
A1C1 CHECK KEYBOARD AND GET KEY IF PRESSED
A26E TABLE OF CODES FOR NON-ALPHA KEYS
A282 OUTPUT CHARACTER
A2BF OUTPUT CHARACTER TO PRINTER (RS232)
A30A OUTPUT CHARACTER TO SCREEN
A390 INPUT LINE FROM KEYBOARD
A416 CLOSE COMMAND
A44C CSAVE COMMAND
A498 CLOAD COMMAND
A4FE CLOADM COMMAND
A53E EXEC COMMAND
A564 INKEY$ FUNCTION
A5CE EOF FUNCTION
A5EC SKIPF
A5F6 OPEN COMMAND
A701 READ BLOCK FROM TAPE
A70B BLOCK IN
A7BD MOTOR COMMAND
A85C SINE TABLE FOR CASSETTE OUT
A880 SET COMMAND
A8B1 RESET COMMAND
A8F5 POINT FUNCTION
A910 CLS COMMAND
A937 PRINT COPYRIGHT (CLS 9)
A94B SOUND COMMAND
A992 AUDIO COMMAND
A9B3 INTERRUPT PROCESSOR (60 HZ COUNTER)
A9C6 JOYSTICK
A9DE READ JOYSTICK VALUES
AA29 FUNCTION ADDRESS TABLE

```
AA51  OPERATION TABLE FOR: + - * / ↑ AND OR
      (3 BYTES EACH: ADDRESSES AND PRECEDENCE VALUES)
AA66  COMMAND NAME TABLE
AB1A  FUNCTION NAME TABLE
AB67  COMMAND ADDRESS TABLE
ABAF  ERROR CODE TABLE
ABE1  TEXT STRINGS
ABF9  SEARCH STACK FOR GOSUB OR FOR
AC1E  OPEN UP SPACE IN MEMORY
AC46  ERROR HANDLER
AC73  IDLE LOOP
AD17  NEW (CLEAR MEMORY)
AD47  FOR COMMAND
AD9E  INTERPRET LOOP
ADEB  CHECK FOR BREAK OR PAUSE
AE02  END COMMAND
AE09  STOP COMMAND
AE30  CONT COMMAND
AE41  CLEAR COMMAND
AE75  RUN COMMAND
AE86  GO COMMAND
AE92  GOSUB COMMAND
AEA4  GOTO COMMAND
AEC0  RETURN COMMAND
AEE2  REM, ELSE
AF14  IF COMMAND
AF42  ON COMMAND
AF67  GET UNSIGNED INTEGER
AF89  LET COMMAND
AFF5  INPUT
B046  READ
B0F8  NEXT COMMAND
B156  GET EXPRESSION
B1CB  ANOTHER ENTRY IN THE OPERATION TABLE
B223  GET OPERAND
B290  EXECUTE FUNCTIONS
B2D4  AND / OR OPERATIONS
B2F4  RELATIONAL OPERATIONS
B34E  DIM
B38F  VARIABLE CREATION
B3E4  EVALUATE INTEGER EXPRESSION
B4EE  MEM FUNCTION
B4FD  STR$ FUNCTION
B518  GET STRING
B681  LEN FUNCTION
B68C  CHR$ FUNCTION
B6A0  ASC FUNCTION
B6AB  LEFT$ FUNCTION
B6C8  RIGHT$ FUNCTION
B6CF  MID$ FUNCTION
B716  VAL FUNCTION
B750  PEEK FUNCTION
B757  POKE COMMAND
B75E  LLIST COMMAND
B764  LIST COMMAND
```

```
B7E6  UNTOKENIZE
B821  TOKENIZE
B8F7  PRINT
B97E  TAB
B99C  PRINT TEXT STRING
B9B4  START OF FLOATING POINT ROUTINES - ROUNDING
B9B9  SUBTRACT FROM FPAC1
B9C2  ADD TO FPAC1
BA79  TWO'S COMPLEMENT FPAC1
BAC5  CONSTANT 1.0
BACA  MULTIPLY
BB2F  MOVE [X] TO FPAC2
BB7D  CONSTANT 10.0
BB91  DIVIDE
BC4A  MOVE FPAC2 TO FPAC1
BC5F  MOVE FPAC1 TO FPAC2
BC6D  TEST FPAC1 FOR ZERO AND SIGN
BC7A  SGN FUNCTION
BCEE  INT FUNCTION
BD12  CONVERT STRING TO FLOATING POINT
BDB6  CONSTANTS - 99999999.9, 999999999, 1E+09
BDD9  CONVERT FPAC1 TO ASCII
BEC0  CONSTANT 0.5
BEC5  SERIES OF 4 BYTE CONSTANTS
BF1F  RND FUNCTION
BF78  SIN FUNCTION
BFBD  CONSTANTS - 2 PI, 0.25
BFC8  SERIES OF 5 BYTE CONSTANTS
BFF0  RESTART VECTORS

A FEW INTERESTING VARIABLES:

0019  START OF USER RAM
001B  TOP OF PGM, BEGIN VARIABLES
001D  TOP OF VARIABLES
001F  TOP OF ARRAYS
0021  TOP OF STACK
0025  MEMORY LIMIT FOR BASIC
0027  PHYSICAL MEMORY LIMIT
004F  FLOATING ACC #1 (6 BYTES)
005C  FLOATING ACC #2 (6 BYTES)
006F  DEVICE NUMBER FOR OUTPUT CHARACTER
0071  RESET FLAG = $55 FOR WARMSTART
0072  RESTART POINTER
008F  START OF AREA DOWNLOADED FROM ROM
0095  BAUD RATE FOR PRINTER (2 BYTES)
0097  CR DELAY (2 BYTES)
0098  COMMA FIELD WIDTH
009A  PRINTER WIDTH
009F  START OF GET NEXT CHARACTER SUBROUTINE
010C  ANOTHER AREA DOWNLOADED FROM ROM
015E  START OF TRAPS (3 BYTE SUBROUTINES WHICH
                      ARE SET TO RTS [$39])
01DA  CASSETTE BUFFER
02DD  INPUT BUFFER
```

MEMORY MAP:

0000 -	03FF	VARIABLES, TEMPS, ETC.
0400 -	05FF	LO-RES SCREEN AREA
0600 -	....	BASIC PROGRAM
		BASIC VARIABLES
		FREE MEMORY
		STACK
		STRINGS
	0FFF	TOP OF MEMORY ON 4K MACHINE
	3FFF	TOP OF MEMORY ON 16K MACHINE
4000 -	7FFF	UNUSED
8000 -	9FFF	EXTENDED BASIC ROM SOCKET
A000 -	BFFF	BASIC ROM
C000 -	FEFF	EXTERNAL ROM SLOT
FF00 -	FF03	KEYBOARD PIA
FF20 -	FF23	VDG / DAC PIA
FFC0 -	FFEF	SAM REGISTERS
FFF0 -	FFFF	RESTART VECTORS (FROM BFF0 - BFFF)

DISASSEMBLING THE EXTENDED BASIC ROM: APPENDIX V

THE EXTENDED BASIC ROM, WHICH IS LOCATED AT ADDRESSES 8000 THROUGH 9FFF, CAN BE DISASSEMBLED CLEANLY USING THE COMMANDS BELOW.

```
START ADDRESS: 0000
END ADDRESS: A000
ADDRESS OFFSET:
SYMBOL TABLE START:
SYMBOL TABLE END:
AREA OPTION: V 0000
AREA OPTION: D 8000
AREA OPTION: P 8002
AREA OPTION: D 80DC
AREA OPTION: S 80E8
AREA OPTION: P 813C
AREA OPTION: S 8183
AREA OPTION: A 81F0
AREA OPTION: S 821E
AREA OPTION: A 8257
AREA OPTION: P 8273
AREA OPTION: D 83AB
AREA OPTION: P 83B0
AREA OPTION: D 83E0
AREA OPTION: P 8446
AREA OPTION: D 84C4
AREA OPTION: P 84F2
AREA OPTION: S 890B
AREA OPTION: P 890F
AREA OPTION: S 8BD9
AREA OPTION: P 8BDD
AREA OPTION: A 929C
AREA OPTION: P 92A6
AREA OPTION: D 92DD
AREA OPTION: P 92E9
AREA OPTION: A 948A
AREA OPTION: P 9494
AREA OPTION: D 9706
AREA OPTION: P 9710
AREA OPTION: D 9839
AREA OPTION: P 9852
AREA OPTION: D 9C5B
AREA OPTION: P 9CB6
AREA OPTION: D 9E79
AREA OPTION: P 9E9D
AREA OPTION:
FULL OUTPUT? . . .
```

```
00002                                   OPT    NOG
00003
00004                          ******************************
00005                          *                            *
00006                          *  GEN80 - DISASSEMBLER      *
00007                          *  ON TRS COLOR COMPUTER     *
00008                          *                            *
00009                          *  COPYRIGHT (c) 1981 BY     *
00010                          *  THE MICRO WORKS, INC.     *
00011                          *  WRITTEN BY ANDREW PHELPS  *
00012                          *  LAST REVISED: 29 MAR 81   *
00013                          *                            *
00014                          ******************************
00015
00016                          *  THIS PROGRAM GENERATES A SOURCE
00017                          *  LISTING FROM A BLOCK OF 6809 MACHINE
00018                          *  CODE.  INFORMATION ABOUT THE BOUNDARIES
00019                          *  OF TEXT STRINGS, VARIABLE AREAS, ETC.,
00020                          *  SUPPLIED BY THE OPERATOR, IS ENTERED
00021                          *  IN THE SYMBOL TABLE.  PASS 1 THEN
00022                          *  FILLS IN THE SYMBOL TABLE; PASS 2 LISTS
00023                          *  THE GENERATED SOURCE.  "SETMSK"
00024                          *  IS CALLED BEFORE PRINTING ANY FIELD
00025                          *  TO DETERMINE IF IT SHOULD BE PRINTED.
00026                          *  IN THE SYMBOL AREA, EXTERNALS GROW
00027                          *  BACK FROM THE END OF THE AREAS WHILE
00028                          *  LABELS GROW FROM THE BEGINNING.
00029
00030                          *
00031                          *  MACRO DEFINITIONS:
00032                          *
00033                          STRG   MACR            TERMINATED STRING
00034                           LBSR INDIS DISPLAY STRING
00035                           FCC "\0" INSERT STRING
00036                           IFEQ NARG-2 IF 2 ARGS
00037                             IFNC \1,RET
00038                               FAIL ILLEGAL STRING OPTION
00039                             ENDC
00040                             FCB $D ADD A CR
00041                           ENDC
00042                           FCB 0 TERMINATE STRING
00043                           ENDM
00044
00045                          T      MACR            TABLE ENTRY
00046                           FCC "\0"
00047                           FCB 0
00048                           FDB $\1,0
00049                           ENDM
00050
00051                          SETMSK MACR            CALL TO SET OUTMASK
00052                           LBSR SMASK
00053                           FCB \0
00054                           ENDM
00055
00056           0000     A TRS80  EQU    0          =0 FOR TRS80, =-1 FOR DOS
```

```
00058                          *
00059                          *  VARIABLES (ALL RELATIVE TO U REGISTER)
00060                          *
00061A 0000      0002    A FIRLAB RMB    2       POINTER TO LABEL AREA
00062A 0002      0002    A LASLAB RMB    2       LAST LABEL + 1
00063A 0004      0002    A CURLAB RMB    2       CURRENT PRINTED LABEL
00064A 0006      0002    A BOTEXT RMB    2       BOTTOM EXTERNAL ENTRY
00065A 0008      0002    A TOPEXT RMB    2       TOP EXTERNAL ENTRY
00066A 000A      0001    A LRESET RMB    1       1 => OLD LABELS PRESENT
00067A 000B      0002    A PAC    RMB    2       PC ADJUSTED FOR PREBYTE
00068A 000D      0002    A PRC    RMB    2       POINTER TO CODE
00069A 000F      0002    A REALPC RMB    2       POINTER TO WHERE CODE WOULD
00070A 0011      0001    A PASS   RMB    1       0 OR 1
00071A 0012      0002    A OFFSET RMB    2       PC-REALPC
00072A 0014      0001    A TFLAG  RMB    1       FOR T OPTION
00073A 0015      0001    A SSTEP  RMB    1       SINGLE STEP FLAG
00074A 0016      0001    A MODE   RMB    1       INSTRUCTION ADDRESS MODE
00075A 0017      0002    A LOOKXT RMB    2       X TEMP FOR LOOKUP
00076A 0019      0002    A MODADR RMB    2       ADDRESS OF MODE PROCESSOR
00077A 001B      0001    A LENGTH RMB    1       BYTES IN INSTRUCTION
00078A 001C      0001    A ALEN   RMB    1       LENGTH MINUS PREBYTE
00079A 001D      0001    A EXTRA  RMB    1       THE 4TH LETTER OF MNEMONIC
00080A 001E      0001    A MNENO  RMB    1       MNEMONIC NUMBER
00081A 001F      0002    A SAVEND RMB    2       USED IN STARTUP
00082A 0021      0002    A SAVSTR RMB    2       USED IN STARTUP
00083A 0023      0002    A LASREF RMB    2       LAST LINE REF SET BY REFERN
00084A 0025      0002    A CURMSK RMB    2       REQUESTED MASK
00085A 0027      0001    A NOCR32 RMB    1       1 => NO CR ON COL 32
00086A 0028      0001    A FULLMD RMB    1       1 => FULL PRINT MODE
00087A 0029      0001    A SCANMD RMB    1       1 => DON'T GO BACK ON EQU *-
00088A 002A      0001    A SLOW   RMB    1       $FF => PRINT DELAY
00089A 002B      0001    A SAVEIT RMB    1       1 => TO BUFFER ON OUTEE
00090A 002C      0001    A COL80  RMB    1       0 => NOT 80 COL
00091A 002D      0001    A PRINTR RMB    1       0 => TO SCREEN ONLY
00092A 002E      0001    A STARS  RMB    1       1 => DON'T PRINT HEX ADDR
00093A 002F      0002    A MASKF  RMB    2       PRINT FIELD MASK
00094A 0031      0001    A COLCNT RMB    1       LAST COLUMN PRINTED
00095A 0032      0001    A DIF    RMB    1       EQU *- VALUE
00096A 0033      0001    A ECFLAG RMB    1       <0 => SYMBOL USED > ONCE
00097A 0034      0002    A XT     RMB    2       TEMP
00098A 0036      0001    A INDFLG RMB    1       INDICATED INDIRECT MODES
00099A 0037      0001    A INDREG RMB    1       INDEX REGISTER (ASCII)
00100A 0038      0001    A DAREA  RMB    1       DATA AREA OR PROG
00101A 0039      0001    A TYPE   RMB    1       USED AT PARAMETER TIME
00102A 003A      0002    A XREFX  RMB    2       TEMP IN XREF
00103A 003C      0002    A REFX   RMB    2       LAST SYMBOL REFERENCED
00104A 003E      0001    A MODOP  RMB    1       PUSH S OR U FLAG
00105A 003F      0001    A CNT    RMB    1       COLUMN COUNTER IN XREF
00106
00107A 0040      0014    A LBF    RMB    20      OPERAND LINE BUFFER
00108            0054    A ENDLBF EQU    *
00109            0054    A NUMVAR EQU    *       TOTAL NUMBER OF VARIABLES
```

```
00111                          *
00112                          *  PROGRAM HEADERS AND LINKAGES
00113                          *
00114                  0000  A        IFEQ   TRS80
00115A 0600                           ORG    $600
00116A 0600            0000  A        FDB    0          SO AS NOT TO
00117A 0602            0000  A        FDB    0          FREAK OUT BASIC ...
00118A 0604 20   11    0617           BRA    START
00119A 0606 6E   9F A002  A OUTCH  JMP    [$A002]  OUT CHARACTER TO SCREEN
00120A 060A 7E   A2BF    A OUTPRT JMP    $A2BF    PRINT CHARACTER
00121A 060D 39                 INTPRT RTS              NO PRINT INIT NEEDED
00122A 060E 7E   A390    A LINEIN JMP    $A390    INPUT EDITED LINE
00123A 0611 6E   9F A000  A POLCAT JMP    [$A000]  CHECK KEYBOARD
00124            02DD    A INBUF  EQU    $2DD     INPUT BUFFER ADDR
00125                           ENDC
00126
00127            0000    A        IFNE   TRS80
00163                           ENDC
00164
00165A 0615      012C    A SCON   FDB    300      SLOW SPEED CONSTANT
00166
00167                          ********************************************************
00168                          *
00169                          *  PROGRAM START
00170                          *
00171A 0617 32   E8 AC   A START  LEAS   -NUMVAR,S LEAVE ROOM FOR VARS
00172A 061A 1F   43      A        TFR    S,U      SAVE STACK FRAME PTR
00173A 061C                     STRG   (SOURCE  GEN 6809),RET
00174A 0630                     STRG   ((C)     1980 BY THE MICRO WORKS),RET
00175A 0650 30   8D 12D9        LEAX   PROEND,PCR
00176A 0654 AF   C4      A      STX    FIRLAB,U
00177A 0656 30   8D 13DB        LEAX   ENDDEF,PCR
00178A 065A AF   42      A      STX    LASLAB,U
00179A 065C 1F   34      A START1 TFR    U,S
00180A 065E 86   01      A        LDA    #1
00181A 0660 A7   4A      A        STA    LRESET,U LABELS NEED RESET
00182A 0662                     STRG   (START   ADDRESS? )
00183A 0675 17   0348 09C0      LBSR   ITYPE1
00184A 0678 26   03   067D      BNE    START2
00185A 067A 8E   FFFF    A      LDX    #$FFFF
00186A 067D AF   C8 21   A START2 STX    SAVSTR,U
00187A 0680                     STRG   (END     ADDRESS? )
00188A 0691 17   032C 09C0      LBSR   ITYPE1
00189A 0694 26   03   0699      BNE    START4
00190A 0696 8E   0000    A      LDX    #0
00191A 0699 AF   C8 1F   A START4 STX    SAVEND,U
00192A 069C                     STRG   (ADDRESS OFFSET? )
00193A 06B0 17   030D 09C0      LBSR   ITYPE1
00194A 06B3 26   03   06B8      BNE    START3
00195A 06B5 8E   0000    A      LDX    #0
00196A 06B8 AF   C8 12   A START3 STX    OFFSET,U
00197A 06BB                     STRG   (SYMBOL  TABLE START? )
00198A 06D3 17   02EA 09C0      LBSR   ITYPE1
00199A 06D6 26   04   06DC      BNE    START5
00200A 06D8 30   8D 1251        LEAX   PROEND,PCR
00201A 06DC AC   C4      A START5 CPX    FIRLAB,U
00202A 06DE 27   06   06E6      BEQ    START7
```

```
00203A 06E0 AF   C4      A          STX    FIRLAB,U
00204A 06E2 AF   42      A          STX    LASLAB,U
00205A 06E4 6F   4A      A          CLR    LRESET,U
00206A 06E6                START7    STRG   (SYMBOL  TABLE END? )
00207A 06FC 17   02C1 09C0          LBSR   ITYPE1
00208A 06FF 26   03   0704          BNE    START6
00209A 0701 30   E8 CE   A          LEAX   -50,S     LEAVE ROOM FOR STACK
00210A 0704 AF   48      A START6   STX    TOPEXT,U  PUT TOP OF EXTERNALS
00211A 0706 AF   46      A          STX    BOTEXT,U  NO EXTS YET
00212A 0708 AE   C8 21   A          LDX    SAVSTR,U  WHERE WAS START
00213A 070B 8C   FFFF    A          CMPX   #$FFFF    DEFAULT?
00214A 070E 27   08   0718          BEQ    START8
00215A 0710 86   50      A          LDA    #'P       TYPE "PROGRAM"
00216A 0712 A7   C8 39   A          STA    TYPE,U
00217A 0715 17   00E5 07FD          LBSR   INSOPT    INSERT TO TABLE
00218A 0718 AE   C8 1F   A START8   LDX    SAVEND,U
00219A 071B 27   08   0725          BEQ    START9    WAS END DEFAULTED?
00220A 071D 86   45      A          LDA    #'E
00221A 071F A7   C8 39   A          STA    TYPE,U    TYPE "END"
00222A 0722 17   00D8 07FD          LBSR   INSOPT    PUT IN SYM TAB
00223A 0725 17   00EA 0812 START9   LBSR   CLEANT    CLEAN OUT SYMBOL TABLE
00224
00225                               *
00226                               *  LOOP TO READ AREA BOUNDARIES
00227                               *
00228A 0728                OPT     STRG   (AREA     OPTION: )
00229A 0739 17   02C5 0A01          LBSR   ITYPE2    GET LETTER/NUMBER
00230A 073C 27   49   0787          BEQ    OPTCR     NO OPTION ENTERED
00231A 073E A6   C8 39   A          LDA    TYPE,U
00232A 0741 81   3F      A          CMPA   #'?       PRINT SYMBOL TABLE
00233A 0743 26   0D   0752          BNE    OPT2
00234A 0745 86   01      A          LDA    #1        PASS TWO
00235A 0747 A7   C8 11   A          STA    PASS,U    SO IT WILL PRINT
00236A 074A 17   00F5 0842          LBSR   SETCRT    OUTPUT TO CRT
00237A 074D 17   0226 0976          LBSR   PXREF     PRINT XREF TABLE
00238A 0750 20   D6   0728          BRA    OPT
00239A 0752 81   50      A OPT2    CMPA   #'P       PROGRAM
00240A 0754 27   2D   0783          BEQ    OPTI
00241A 0756 81   53      A          CMPA   #'S       STRING
00242A 0758 27   29   0783          BEQ    OPTI
00243A 075A 81   44      A          CMPA   #'D       DATA
00244A 075C 27   25   0783          BEQ    OPTI
00245A 075E 81   41      A          CMPA   #'A       ADDRESSES
00246A 0760 27   21   0783          BEQ    OPTI
00247A 0762 81   56      A          CMPA   #'V       VARIABLES
00248A 0764 27   1D   0783          BEQ    OPTI
00249A 0766 81   45      A          CMPA   #'E       END
00250A 0768 27   19   0783          BEQ    OPTI
00251A 076A 81   54      A          CMPA   #'T       TABLE
00252A 076C 27   15   0783          BEQ    OPTI
00253A 076E                         STRG   (ILLEGAL OPTION),RET
00254A 0781 20   A5   0728          BRA    OPT
00255                               *
00256A 0783 8D   78   07FD OPTI    BSR    INSOPT    INSERT IT
00257A 0785 20   A1   0728          BRA    OPT       LOOP
00258                               *
00259A 0787 6D   4A      A OPTCR   TST    LRESET,U
```

```
00260A 0789 26   32   07BD          BNE    OPTCR2
00261A 078B AE   42      A          LDX    LASLAB,U
00262A 078D 30   14      A          LEAX   -12,X     MUST BE TWO ENTRIES
00263A 078F AC   C4      A          CMPX   FIRLAB,U
00264A 0791 1024 00BC 0851          LBHS   INGO      OK; AT LEAST TWO
00265A 0795                         STRG   (MUST     HAVE AT LEAST START AND END)
00266A 07BA 16   FF6B 0728          LBRA   OPT       NO DEFAULT TO GO TO
00267A 07BD                  OPTCR2 STRG   (NON-DEFAULT AREAS? )
00268A 07D4 17   0268 0A3F          LBSR   ITYPE3    YES-NO
00269A 07D7 1026 FF4D 0728          LBNE   OPT       IF YES
00270A 07DB 6F   4A      A          CLR    LRESET,U
00271A 07DD 8D   33   0812          BSR    CLEANT
00272A 07DF                         STRG   (ANY      OTHER AREAS? )
00273A 07F4 17   0248 0A3F          LBSR   ITYPE3    YES-NO
00274A 07F7 1026 FF2D 0728          LBNE   OPT       IF YES
00275A 07FB 20   54   0851          BRA    INGO
00276                          *
00277                          *  INSERT AREA OPTION INTO TABLE
00278                          *
00279A 07FD 6D   4A      A  INSOPT TST    LRESET,U NEED TO RESET?
00280A 07FF 27   06   0807          BEQ    INSOP2   OK IF NOT
00281A 0801 EC   C4      A          LDD    FIRLAB,U START OF TABLE
00282A 0803 ED   42      A          STD    LASLAB,U IS NOW END TOO
00283A 0805 6F   4A      A          CLR    LRESET,U DON'T RESET AGAIN
00284A 0807 1F   10      A  INSOP2 TFR    X,D
00285A 0809 17   064B 0E57          LBSR   LOOKLA    LOOK UP SYMBOL
00286A 080C A6   C8 39   A          LDA    TYPE,U    SET TO WHAT TYPE
00287A 080F A7   84      A          STA    0,X       PUT TYPE INTO TABLE
00288A 0811 39                      RTS
00289                          *
00290                          *  CLEAN OUT UNNEEDED SYMBOLS
00291                          *
00292A 0812 AE   48      A  CLEANT LDX    TOPEXT,U
00293A 0814 AF   46      A          STX    BOTEXT,U
00294A 0816 AE   C4      A          LDX    FIRLAB,U
00295A 0818 1F   12      A          TFR    X,Y
00296A 081A 6F   C8 39   A          CLR    TYPE,U
00297A 081D 10AC 42      A  CLEAN2 CMPY   LASLAB,U
00298A 0820 27   1D   083F          BEQ    CLEAN3
00299A 0822 EC   A4      A          LDD    0,Y
00300A 0824 84   7F      A          ANDA   #$7F      CLEAR FLAG BIT
00301A 0826 A7   A4      A          STA    0,Y
00302A 0828 A1   C8 39   A          CMPA   TYPE,U    SAME AS LAST TYPE?
00303A 082B 27   0E   083B          BEQ    CLEAN4
00304A 082D A7   C8 39   A          STA    TYPE,U    RECORD NEW TYPE
00305A 0830 ED   81      A          STD    ,X++      MOVE SYMBOL DOWN
00306A 0832 EC   22      A          LDD    2,Y
00307A 0834 ED   81      A          STD    ,X++
00308A 0836 CC   0000    A          LDD    #0
00309A 0839 ED   81      A          STD    ,X++      NO XREF
00310A 083B 31   26      A  CLEAN4 LEAY   6,Y       MOVE POINTER UP
00311A 083D 20   DE   081D          BRA    CLEAN2
00312A 083F AF   42      A  CLEAN3 STX    LASLAB,U SAVE END POINTER
00313A 0841 39                      RTS
00314                          *
00315                          *  SET PARAMETERS FOR CRT
00316                          *
```

```
00317A 0842 6F   C8 15   A SETCRT CLR    SSTEP,U  NOT SINGLE STEP
00318A 0845 6F   C8 2D   A        CLR    PRINTR,U NOT TO PRINTER
00319A 0848 86   01      A        LDA    #1
00320A 084A A7   C8 27   A        STA    NOCR32,U NO CR ON COL 32
00321A 084D 6F   C8 2C   A        CLR    COL80,U  NOT 80 COLUMNS
00322A 0850 39                    RTS
00323                        *
00324                        *  DECIDE ON OUTPUT FORMAT
00325                        *
00326A 0851 86   01      A INGO   LDA    #1
00327A 0853 A7   4A      A        STA    LRESET,U LABELS NOW NEED RESET
00328A 0855 17   032A 0B82        LBSR   STFULL
00329A 0858                       STRG   (FULL    OUTPUT?)
00330A 0868 17   01D4 0A3F        LBSR   ITYPE3
00331A 086B 26   1B   0888        BNE    ING03
00332A 086D 17   031D 0B8D        LBSR   STSCAN
00333A 0870                       STRG   (SCAN    FORMAT?)
00334A 0880 17   01BC 0A3F        LBSR   ITYPE3
00335A 0883 26   03   0888        BNE    ING03
00336A 0885 17   030D 0B95        LBSR   STDEFL
00337                        *
00338                        *  DECIDE ON OUTPUT UNIT
00339                        *
00340A 0888 8D   B8   0842 ING03  BSR    SETCRT
00341A 088A                       STRG   (TO      PRINTER? )
00342A 089A 17   01A2 0A3F        LBSR   ITYPE3   GET YES NO
00343            0000    A        IFEQ   TRS80
00344A 089D 27   43   08E2        BEQ    ING02    IF NO, CR32 OK
00345                             ENDC
00346            0000    A        IFNE   TRS80
00348                             ENDC
00349A 089F 6C   C8 2D   A        INC    PRINTR,U
00350A 08A2 17   FD68 060D        LBSR   INTPRT   INIT PRINTER
00351A 08A5                       STRG   (80-COLUMN? )
00352A 08B4 17   0188 0A3F        LBSR   ITYPE3
00353A 08B7 27   08   08C1        BEQ    ING04    IF NO
00354A 08B9 6C   C8 2C   A        INC    COL80,U
00355A 08BC 6F   C8 27   A        CLR    NOCR32,U
00356A 08BF 20   21   08E2        BRA    ING02
00357A 08C1                  ING04  STRG   (NO      CR ON COL 32?)
00358A 08D5 6F   C8 27   A        CLR    NOCR32,U
00359A 08D8 17   0164 0A3F        LBSR   ITYPE3   GET YES NO
00360A 08DB 27   05   08E2        BEQ    ING02
00361A 08DD 86   01      A        LDA    #1
00362A 08DF A7   C8 27   A        STA    NOCR32,U
00363            08E2    A ING02  EQU    *
00364                        *
00365                        *  INIT FOR PASS ONE
00366                        *
00367A 08E2 AE   C4      A        LDX    FIRLAB,U
00368A 08E4 AF   44      A        STX    CURLAB,U
00369A 08E6 AE   02      A        LDX    2,X
00370A 08E8 AF   4F      A        STX    REALPC,U
00371A 08EA 6F   C8 11   A        CLR    PASS,U
00372A 08ED 17   0320 0C10        LBSR   DOPASS   BUILD SYMBOL TABLE
00373                        *
00374                        *  PRINT HEADING & EXTERNALS
```

```
00375                                *
00376A 08F0 86   01       A          LDA    #1
00377A 08F2 A7   C8 11    A          STA    PASS,U
00378A 08F5 86   FF       A          LDA    #$FF      START AT SLOW SPEED
00379A 08F7 A7   C8 2A    A          STA    SLOW,U    AND COMPLEMENT ON "S"
00380A 08FA 6F   C8 2B    A          CLR    SAVEIT,U PRINTING OK
00381A 08FD                          SETMSK 13
00382A 0901 17   08D4 11D8          LBSR   CRLF
00383A 0904 CC   0000     A          LDD    #0
00384A 0907 ED   4F       A          STD    REALPC,U
00385A 0909 17   0770 107C          LBSR   DATCOL
00386A 090C 17   03F3 0D02          LBSR   LABEL2    NULL LABEL
00387A 090F                          SETMSK 13
00388A 0913 17   08C6 11DC          LBSR   PDATAI
00389A 0916      4E       A          FCC    /NAM  DISASM/
00390A 0921      00       A          FCB    0
00391A 0922 17   08B3 11D8          LBSR   CRLF
00392A 0925 AE   C4       A          LDX    FIRLAB,U
00393A 0927 AE   02       A          LDX    2,X
00394A 0929 AF   4F       A          STX    REALPC,U
00395A 092B 17   074E 107C          LBSR   DATCOL    PRINT DATA COLUMNS
00396A 092E 17   03D1 0D02          LBSR   LABEL2    NULL LABEL
00397A 0931                          SETMSK 13
00398A 0935 17   08A4 11DC          LBSR   PDATAI
00399A 0938      4F       A          FCC    /ORG  $/
00400A 093E      00       A          FCB    0
00401A 093F 30   4F       A          LEAX   REALPC,U
00402A 0941 17   084B 118F          LBSR   OUTADR    ORG ADDRESS
00403A 0944 17   0891 11D8          LBSR   CRLF
00404A 0947 17   0350 0C9A          LBSR   EXTERN    PRINT LIST OF EXTERNALS
00405                                *
00406                                *  PASS TWO
00407                                *
00408A 094A AE   C4       A          LDX    FIRLAB,U
00409A 094C EC   02       A          LDD    2,X
00410A 094E ED   4F       A          STD    REALPC,U
00411A 0950 AE   C4       A DO2      LDX    FIRLAB,U
00412A 0952 AF   44       A          STX    CURLAB,U
00413A 0954 6F   C8 15    A          CLR    SSTEP,U   NOT SINGLE STEPPING
00414A 0957 6F   C8 2E    A          CLR    STARS,U   NOT BACKTRACK FIELD
00415A 095A 17   02B3 0C10          LBSR   DOPASS    DO PASS TWO
00416A 095D 17   071C 107C          LBSR   DATCOL    PRINT DATA FOR END STMT
00417A 0960 17   039F 0D02          LBSR   LABEL2    LEAVE LABEL BLANK
00418A 0963                          SETMSK 13        ALWAYS PRINT
00419A 0967 17   0872 11DC          LBSR   PDATAI    PRINT "END" STMT
00420A 096A      45       A          FCC    /END/
00421A 096D      00       A          FCB    0
00422A 096E 17   0867 11D8          LBSR   CRLF
00423A 0971 8D   03   0976          BSR    PXREF
00424A 0973 16   0266 0BDC          LBRA   RESTA
00425                                *
00426                                *  PRINT XREF TABLE
00427                                *
00428A 0976 AE   C4       A PXREF    LDX    FIRLAB,U
00429A 0978 AF   C8 3A    A          STX    XREFX,U
00430A 097B 86   04       A XREF1    LDA    #4        NUMBER OF COLS
00431A 097D 6D   C8 2C    A          TST    COL80,U
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00432A 0980 26   02   0984        BNE    XREF5
00433A 0982 86   02      A        LDA    #2
00434A 0984 A7   C8 3F   A XREF5  STA    CNT,U
00435A 0987 17   084E 11D8        LBSR   CRLF
00436A 098A 17   0163 0AF0 XREF2  LBSR   PASCHK   STEP/BREAK
00437A 098D AE   C8 3A   A        LDX    XREFX,U
00438A 0990 AC   42      A        CPX    LASLAB,U
00439A 0992 26   0A   099E        BNE    XREF3
00440A 0994 AE   46      A        LDX    BOTEXT,U
00441A 0996 AF   C8 3A   A        STX    XREFX,U
00442A 0999 17   083C 11D8        LBSR   CRLF
00443A 099C 20   DD   097B        BRA    XREF1
00444A 099E AC   48      A XREF3  CPX    TOPEXT,U
00445A 09A0 27   1B   09BD        BEQ    XREF4
00446A 09A2 17   0575 0F1A        LBSR   PRLAB    PRINT XREF LABEL NAME
00447A 09A5 17   07EB 1193        LBSR   OUTSP
00448A 09A8 AE   C8 3A   A        LDX    XREFX,U
00449A 09AB 30   04      A        LEAX   4,X
00450A 09AD 17   07DF 118F        LBSR   OUTADR   XREF TOP OF THREAD
00451A 09B0 AF   C8 3A   A        STX    XREFX,U
00452A 09B3 17   07D5 118B        LBSR   OUTSP2   PRINT 2 SPACES
00453A 09B6 6A   C8 3F   A        DEC    CNT,U
00454A 09B9 26   CF   098A        BNE    XREF2
00455A 09BB 20   BE   097B        BRA    XREF1
00456A 09BD 16   0818 11D8 XREF4  LBRA   CRLF
00457                      *
00458                      *  INPUT LINE AND PARSE
00459                      *
00460A 09C0 17   FC4B 060E ITYPE1 LBSR   LINEIN   $$$$
00461A 09C3 25   29   09EE        BCS    BRAK
00462A 09C5 8E   02DD    A        LDX    #INBUF
00463A 09C8 17   009C 0A67        LBSR   GNUM
00464A 09CB 26   02   09CF        BNE    IERR
00465A 09CD 5D                    TSTB
00466A 09CE 39                    RTS    ITRTS
00467                      *
00468A 09CF                IERR   STRG   (ENTER   A NUMBER OR RETURN),RET
00469A 09EC 20   D2   09C0        BRA    ITYPE1
00470                      *
00471                      *  BREAK KEY ON INPUT
00472                      *
00473A 09EE                BRAK   STRG   (**      BREAK **),RET
00474A 09FE 16   FC5B 065C        LBRA   START1
00475                      *
00476                      *  GET AN AREA PARAMETER
00477                      *
00478A 0A01 17   FC0A 060E ITYPE2 LBSR   LINEIN   X $$$$
00479A 0A04 25   E8   09EE        BCS    BRAK     WAS THERE A BREAK?
00480A 0A06 8E   02DD    A        LDX    #INBUF
00481A 0A09 A6   80      A        LDA    ,X+      GET FIRST CHAR
00482A 0A0B 27   C1   09CE        BEQ    ITRTS    NOTHING ON LINE
00483A 0A0D A7   C8 39   A        STA    TYPE,U
00484A 0A10 81   3F      A        CMPA   #'?      ASKING FOR TABLE DUMP?
00485A 0A12 27   51   0A65        BEQ    TYP3Y
00486A 0A14 A6   80      A        LDA    ,X+      SECOND LETTER
00487A 0A16 81   20      A        CMPA   #$20     MUST BE SPACE
00488A 0A18 26   08   0A22        BNE    IERR2
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00489A 0A1A 8D   4B   0A67          BSR    GNUM      GET A NUMBER
00490A 0A1C 26   04   0A22          BNE    IERR2
00491A 0A1E 5D                      TSTB
00492A 0A1F 27   01   0A22          BEQ    IERR2
00493A 0A21 39                      RTS
00494                         *
00495A 0A22                   IERR2 STRG   (ENTER    IN FORM:  X $$$$),RET
00496A 0A3D 20   C2   0A01          BRA    ITYPE2
00497                         *
00498A 0A3F 17   FBCC 060E    ITYPE3 LBSR   LINEIN    YES/NO
00499A 0A42 25   AA   09EE          BCS    BRAK
00500A 0A44 B6   02DD    A          LDA    INBUF
00501A 0A47 27   1D   0A66          BEQ    TYP3R     DEFAULT?
00502A 0A49 81   59       A         CMPA   #'Y       WAS IT YES?
00503A 0A4B 27   18   0A65          BEQ    TYP3Y
00504A 0A4D 81   4E       A         CMPA   #'N       OR "NO"?
00505A 0A4F 27   13   0A64          BEQ    TYP3N
00506A 0A51                         STRG   (ENTER    Y OR N),RET
00507A 0A62 20   DB   0A3F          BRA    ITYPE3    TRY AGAIN
00508                         *
00509A 0A64 4F                TYP3N CLRA
00510A 0A65 4D                TYP3Y TSTA
00511A 0A66 39                TYP3R RTS
00512                         *
00513                         *  HEX AND DECIMAL INPUT
00514                         *
00515A 0A67 CC   0000     A   GNUM   LDD    #0
00516A 0A6A 34   06       A          PSHS   D         INITIALIZE TOTAL
00517A 0A6C A6   84       A          LDA    ,X        GET A CHARACTER
00518A 0A6E 81   2E       A          CMPA   #'.       DECIMAL INPUT?
00519A 0A70 27   30   0AA2          BEQ    GDEC
00520A 0A72 A6   80       A  GNUM2  LDA    ,X+       GET A CHARACTER
00521A 0A74 81   30       A          CMPA   #'0
00522A 0A76 25   27   0A9F          BLO    GNUM3
00523A 0A78 81   39       A          CMPA   #'9
00524A 0A7A 23   0A   0A86          BLS    GNUM4
00525A 0A7C 81   41       A          CMPA   #'A
00526A 0A7E 25   1F   0A9F          BLO    GNUM3
00527A 0A80 81   46       A          CMPA   #'F
00528A 0A82 22   1B   0A9F          BHI    GNUM3
00529A 0A84 80   07       A          SUBA   #7
00530A 0A86 80   30       A  GNUM4  SUBA   #'0       MAKE NUMERIC
00531A 0A88 68   61       A          ASL    1,S       SHIFT INTO TOTAL
00532A 0A8A 69   E4       A          ROL    0,S
00533A 0A8C 68   61       A          ASL    1,S
00534A 0A8E 69   E4       A          ROL    0,S
00535A 0A90 68   61       A          ASL    1,S
00536A 0A92 69   E4       A          ROL    0,S
00537A 0A94 68   61       A          ASL    1,S
00538A 0A96 69   E4       A          ROL    0,S
00539A 0A98 AB   61       A          ADDA   1,S
00540A 0A9A A7   61       A          STA    1,S
00541A 0A9C 5C                      INCB              COUNT CHARACTERS
00542A 0A9D 20   D3   0A72          BRA    GNUM2
00543                         *
00544A 0A9F 4D                GNUM3 TSTA              LAST CHAR A RETURN?
00545A 0AA0 35   90       A          PULS   X,PC
```

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00546                                   *
00547                                   *  DECIMAL
00548                                   *
00549A 0AA2 30    01       A GDEC    LEAX    1,X       OVER THE "."
00550A 0AA4 A6    80       A GDEC2   LDA     ,X+
00551A 0AA6 81    30       A         CMPA    #'0
00552A 0AA8 25    27    0AD1         BLO     GDEC3
00553A 0AAA 81    39       A         CMPA    #'9
00554A 0AAC 22    23    0AD1         BHI     GDEC3
00555A 0AAE 80    30       A         SUBA    #'0
00556A 0AB0 34    06       A         PSHS    A,B
00557A 0AB2 C6    0A       A         LDB     #10       MULTIPLY LSB BY 10
00558A 0AB4 A6    63       A         LDA     2+1,S
00559A 0AB6 3D                       MUL
00560A 0AB7 E7    63       A         STB     2+1,S
00561A 0AB9 34    02       A         PSHS    A
00562A 0ABB C6    0A       A         LDB     #10       MULTIPLY MSB BY 10
00563A 0ABD A6    63       A         LDA     1+2+0,S
00564A 0ABF 3D                       MUL
00565A 0AC0 EB    E0       A         ADDB    ,S+
00566A 0AC2 E7    62       A         STB     2+0,S
00567A 0AC4 35    06       A         PULS    A,B
00568A 0AC6 AB    61       A         ADDA    1,S       ADD ON NEW DIGIT
00569A 0AC8 A7    61       A         STA     1,S
00570A 0ACA 24    02    0ACE         BCC     GDEC4
00571A 0ACC 6C    E4       A         INC     0,S       ADD CARRY
00572A 0ACE 5C                    GDEC4  INCB
00573A 0ACF 20    D3    0AA4         BRA     GDEC2
00574                                   *
00575A 0AD1 4D                    GDEC3  TSTA
00576A 0AD2 35    90       A         PULS    X,PC
00577                                   *
00578                                   *  SET OUTPUT MASK
00579                                   *
00580A 0AD4 34    16       A SMASK   PSHS    D,X       SAVE REGISTERS
00581A 0AD6 AE    64       A         LDX     4,S       RET ADR
00582A 0AD8 A6    80       A         LDA     ,X+       GET PARAMETER
00583A 0ADA 6F    64       A         CLR     4,S       USE RET ADR AS TEMP
00584A 0ADC 6F    65       A         CLR     5,S
00585A 0ADE 1A    01                  SEC               FOR FIRST ROTATE
00586A 0AE0 69    65       A SMA2    ROL     5,S       MOVE THE BIT OVER
00587A 0AE2 69    64       A         ROL     4,S
00588A 0AE4 4A                       DECA              COUNT DOWN PARAMETER
00589A 0AE5 2A    F9    0AE0         BPL     SMA2
00590A 0AE7 EC    64       A         LDD     4,S       GET RESULT
00591A 0AE9 AF    64       A         STX     4,S       RESTORE NEW RET ADR
00592A 0AEB ED    C8 2F    A         STD     MASKF,U   SAVE THE NEW MASK
00593A 0AEE 35    96       A         PULS    D,X,PC    RESTORE & RETURN
00594                                   *
00595                                   *  PAUSE / BREAK CHECK
00596                                   *
00597A 0AF0 A6    C8 15    A PASCHK  LDA     SSTEP,U   ARE WE SINGLE STEP?
00598A 0AF3 26    11    0B06         BNE     PSTEP
00599A 0AF5 17    FB19  0611         LBSR    POLCAT    CHECK KEYBOARD
00600A 0AF8 27    07    0B01         BEQ     RTS3
00601A 0AFA 81    53       A         CMPA    #'S       SLOW DOWN?
00602A 0AFC 26    04    0B02         BNE     PSTEP2
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00603A 0AFE 63    C8 2A    A          COM     SLOW,U    TOGGLE SLOW FLAG
00604A 0B01 39                RTS3    RTS
00605A 0B02 81    20       A PSTEP2  CMPA    #$20      SPACE (STEP)
00606A 0B04 26    4E    0B54         BNE     PBE2
00607A 0B06 6F    C8 15    A PSTEP   CLR     SSTEP,U   ELSE NOT SINGLE STEP
00608A 0B09 6D    C8 11    A         TST     PASS,U
00609A 0B0C 26    13    0B21         BNE     PSTEP3    IF PASS 2
00610A 0B0E                          STRG    (PASS     1 STOPPED),RET
00611A 0B21 17    FAED 0611 PSTEP3   LBSR    POLCAT    GET ANOTHER KEY
00612A 0B24 27    FB    0B21         BEQ     PSTEP3    (WAIT FOR IT)
00613A 0B26 81    03       A         CMPA    #3        BREAK
00614A 0B28 1027  0088 0BB4         LBEQ    BREAK
00615A 0B2C 81    13       A         CMPA    #$13      SHIFT-@
00616A 0B2E 27    09    0B39         BEQ     PBE
00617A 0B30 81    20       A         CMPA    #$20
00618A 0B32 26    3B    0B6F         BNE     PASOK2
00619A 0B34 A7    C8 15    A         STA     SSTEP,U   START SINGLE-STEP
00620A 0B37 20    48    0B81         BRA     PASOK
00621                          *
00622A 0B39 A6    C8 11    A PBE     LDA     PASS,U
00623A 0B3C 26    11    0B4F         BNE     PBE5
00624A 0B3E                          STRG    (PASS     1 PAUSE),RET
00625A 0B4F 17    FABF 0611 PBE5     LBSR    POLCAT
00626A 0B52 27    FB    0B4F         BEQ     PBE5
00627A 0B54 81    03       A PBE2    CMPA    #3        BREAK
00628A 0B56 27    5C    0BB4         BEQ     BREAK
00629A 0B58 81    13       A         CMPA    #$13      SHIFT-@
00630A 0B5A 27    DD    0B39         BEQ     PBE
00631A 0B5C 80    31       A         SUBA    #'1       NUMBERS = MODES
00632A 0B5E 27    22    0B82         BEQ     STFULL    FULL MODE
00633A 0B60 4A                       DECA
00634A 0B61 27    2A    0B8D         BEQ     STSCAN    SCAN MODE
00635A 0B63 4A                       DECA
00636A 0B64 27    2F    0B95         BEQ     STDEFL    DEFAULT MODE
00637A 0B66 4A                       DECA
00638A 0B67 27    31    0B9A         BEQ     STREAS    REASSEMBLY MODE
00639A 0B69 4A                       DECA
00640A 0B6A 27    36    0BA2         BEQ     STXREF    XREF MODE
00641A 0B6C 4A                       DECA
00642A 0B6D 27    38    0BA7         BEQ     STREFX    REFERENCE MODE
00643A 0B6F A6    C8 11    A PASOK2  LDA     PASS,U
00644A 0B72 26    0D    0B81         BNE     PASOK
00645A 0B74                          STRG    (GOING...),RET
00646A 0B81 39                PASOK   RTS
00647                          *
00648                          *  CHANGE FORMAT MODES
00649                          *
00650A 0B82 6F    C8 29    A STFULL  CLR     SCANMD,U  FULL MODE
00651A 0B85 CC    77EF     A         LDD     #$77EF
00652A 0B88 A7    C8 28    A         STA     FULLMD,U
00653A 0B8B 20    23    0BB0         BRA     SEMODE
00654                          *
00655A 0B8D CC    A80D     A STSCAN  LDD     #$A80D    SCAN MODE
00656A 0B90 A7    C8 29    A         STA     SCANMD,U
00657A 0B93 20    18    0BAD         BRA     SSMODE
00658                          *
00659A 0B95 CC    3015     A STDEFL  LDD     #$3015    DEFAULT MODE
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00660A 0B98 20   10   0BAA          BRA     SCMODE
00661                          *
00662A 0B9A CC   3000    A STREAS  LDD     #$3000    REASSEMBLY - NO DATA COLS
00663A 0B9D A7   C8 29   A         STA     SCANMD,U
00664A 0BA0 20   0B   0BAD         BRA     SSMODE
00665                          *
00666A 0BA2 CC   3041    A STXREF  LDD     #$3041    XREF MODE
00667A 0BA5 20   03   0BAA         BRA     SCMODE
00668                          *
00669A 0BA7 CC   3060    A STREFX  LDD     #$3060    REFERENCE MODE
00670A 0BAA 6F   C8 29   A SCMODE  CLR     SCANMD,U
00671A 0BAD 6F   C8 28   A SSMODE  CLR     FULLMD,U
00672A 0BB0 ED   C8 25   A SEMODE  STD     CURMSK,U
00673A 0BB3 39                     RTS
00674                          *
00675                          *  BREAK KEY WHILE PRINTING
00676                          *
00677A 0BB4 A6   C8 11   A BREAK   LDA     PASS,U
00678A 0BB7 26   21   0BDA         BNE     P2B
00679A 0BB9                        STRG    (***      BREAK IN PASS ONE ***),RET
00680A 0BD7 16   FA82 065C         LBRA    START1
00681                          *
00682A 0BDA 32   64       A P2B    LEAS    4,S       RET FROM PASCHK & DOPASS
00683                          *
00684A 0BDC                RESTA   STRG    (RESTART WHERE? )
00685A 0BEF 17   FDCE 09C0         LBSR    ITYPE1
00686A 0BF2 26   17   0C0B         BNE     P2B2
00687A 0BF4                        STRG    (***      RESTART ***),RET
00688A 0C08 16   FA51 065C         LBRA    START1
00689                          *
00690A 0C0B AF   4F       A P2B2   STX     REALPC,U
00691A 0C0D 16   FD40 0950         LBRA    DO2
00692
00693                          *
00694                          *  CONTROL LOOP TO DISASSEMBLE LINE
00695                          *
00696A 0C10 17   FEDD 0AF0 DOPASS  LBSR    PASCHK    PAUSE/BREAK TEST
00697A 0C13 AE   44       A        LDX     CURLAB,U  CURRENT LABEL
00698A 0C15 AC   42       A        CMPX    LASLAB,U  END OF TABLE?
00699A 0C17 22   47   0C60         BHI     RTS2      LEAVE IF SO
00700A 0C19 EC   02       A        LDD     2,X       ADDRESS OF LABEL
00701A 0C1B A3   4F       A        SUBD    REALPC,U  ARE WE THERE?
00702A 0C1D 22   14   0C33         BHI     DOPAS2
00703A 0C1F 6F   C8 14   A         CLR     TFLAG,U   IN CASE A "T" AREA
00704A 0C22 A6   84       A        LDA     X         GET TYPE
00705A 0C24 84   7F       A        ANDA    #$7F      MASK XREF BIT
00706A 0C26 A7   C8 38   A         STA     DAREA,U   NEW AREA TYPE
00707A 0C29 81   45       A        CMPA    #'E       TYPE "END"?
00708A 0C2B 27   33   0C60         BEQ     RTS2
00709A 0C2D EC   4F       A        LDD     REALPC,U
00710A 0C2F A3   02       A        SUBD    2,X       ARE WE PAST IT?
00711A 0C31 26   04   0C37         BNE     DOPAS5
00712A 0C33 8D   31   0C66 DOPAS2  BSR     DOLINE    DISASSEMBLE THE LINE
00713A 0C35 20   D9   0C10         BRA     DOPASS    AND LOOP
00714                          *
00715                          *  GONE PAST A LABEL - IGNORE IT?
00716                          *
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00717A 0C37 1083 0005    A DOPAS5 CMPD   #5         FAR PAST IT?
00718A 0C3B 25   06   0C43        BLO    DOPAS7
00719A 0C3D 30   06      A        LEAX   6,X        MOVE TO NEXT LABEL
00720A 0C3F AF   44      A        STX    CURLAB,U  NEW CURRENT LABEL
00721A 0C41 20   CD   0C10        BRA    DOPASS    AND FORGET IT
00722                             *
00723                             *  GONE PAST A LABEL - PRINT EXTRA LINE
00724                             *
00725A 0C43 6D   C8 29   A DOPAS7 TST    SCANMD,U
00726A 0C46 26   19   0C61        BNE    DOPAS1    DON'T GO BACK IN SCAN MODE
00727A 0C48 EC   4F      A        LDD    REALPC,U
00728A 0C4A 34   06      A        PSHS   D         SAVE PC
00729A 0C4C EC   02      A        LDD    2,X
00730A 0C4E ED   4F      A        STD    REALPC,U  MOVE PC BACK
00731A 0C50 86   01      A        LDA    #1
00732A 0C52 A7   C8 2E   A        STA    STARS,U   FLAG THE LINE
00733A 0C55 8D   0F   0C66        BSR    DOLINE    AND DO IT
00734A 0C57 35   06      A        PULS   D         RESTORE PC
00735A 0C59 ED   4F      A        STD    REALPC,U
00736A 0C5B 6F   C8 2E   A        CLR    STARS,U   CLEAR FLAG
00737A 0C5E 20   B0   0C10        BRA    DOPASS    AND LOOP
00738A 0C60 39                    RTS2   RTS
00739                             *
00740A 0C61 17   03C6 102A DOPAS1 LBSR   EQUS       PRINT "EQU *-n"
00741A 0C64 20   AA   0C10        BRA    DOPASS    LOOP FOR NEXT LINE
00742                             *
00743                             *  DISASSEMBLE AS RMB, STRING, OR DATA/CODE
00744                             *
00745A 0C66 EC   4F      A DOLINE LDD    REALPC,U  GET PC
00746A 0C68 E3   C8 12   A        ADDD   OFFSET,U  FORM ACTUAL ADDRESS
00747A 0C6B ED   4D      A        STD    PRC,U     SAVE IT
00748A 0C6D A6   C8 38   A        LDA    DAREA,U   CHECK FOR RMB AREA
00749A 0C70 81   56      A        CMPA   #'V       IS IT "VAR"S?
00750A 0C72 1027 00A0 0D16        LBEQ   RMB       IF SO, PRINT "RMB"
00751A 0C76 81   53      A        CMPA   #'S       IS IT A STRING
00752A 0C78 26   0F   0C89        BNE    DOPAS3
00753A 0C7A AE   4D      A        LDX    PRC,U
00754A 0C7C A6   84      A        LDA    0,X       GET THE CHARACTER
00755A 0C7E 81   20      A        CMPA   #$20      IT IT TEXT?
00756A 0C80 25   07   0C89        BLO    DOPAS3    DO FCB IF NOT
00757A 0C82 81   7F      A        CMPA   #$7F      OR IF TOO BIG
00758A 0C84 24   03   0C89        BHS    DOPAS3
00759A 0C86 16   015E 0DE7        LBRA   FCC       IF TEXT, DO FCC
00760                             *
00761                             *  NORMAL INSTRUCTION OR DATA
00762                             *
00763A 0C89 17   02D5 0F61 DOPAS3 LBSR   LOOKOP    FIND TYPE OF OPERATION
00764A 0C8C 17   0121 0DB0        LBSR   GENOPN    BUILD OPERAND OUTPUT
00765A 0C8F 17   03F3 1085        LBSR   PRDATC    PRINT DATA ROW
00766A 0C92 8D   4B   0CDF        BSR    LABEL     PRINT LABEL
00767A 0C94 17   00BA 0D51        LBSR   PRINTL    PRINT SOURCE OF LINE
00768A 0C97 16   01A1 0E3B        LBRA   BUMPPC    UPDATE PC AND RETURN
00769                             *
00770                             *  EXTERNAL LIST
00771                             *
00772A 0C9A EC   C8 25   A EXTERN LDD    CURMSK,U
00773A 0C9D 85   10      A        BITA   #$10      BIT 12 = LABEL
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00774A 0C9F 27   3D   0CDE          BEQ    EX2        FORGET IT IF NO LABELS
00775A 0CA1 AE   46      A          LDX    BOTEXT,U
00776A 0CA3 AF   C8 3A   A          STX    XREFX,U
00777A 0CA6 17   FE47 0AF0 EX3      LBSR   PASCHK     CHECK STEP & BREAK
00778A 0CA9 AE   C8 3A   A          LDX    XREFX,U
00779A 0CAC AC   48      A          CPX    TOPEXT,U
00780A 0CAE 27   2E   0CDE          BEQ    EX2        DONE?
00781A 0CB0 AE   02      A          LDX    2,X
00782A 0CB2 AF   4F      A          STX    REALPC,U
00783A 0CB4 17   03C5 107C          LBSR   DATCOL     PRINT DATA COLUMNS
00784A 0CB7 AE   C8 3A   A          LDX    XREFX,U
00785A 0CBA                         SETMSK 13
00786A 0CBE 17   0259 0F1A          LBSR   PRLAB      PRINT EXT SYMBOL
00787A 0CC1 17   0518 11DC          LBSR   PDATAI
00788A 0CC4      20      A          FCC    / EQU  $/
00789A 0CCB      00      A          FCB    0
00790A 0CCC AE   C8 3A   A          LDX    XREFX,U
00791A 0CCF 30   02      A          LEAX   2,X
00792A 0CD1 17   04BB 118F          LBSR   OUTADR     PRINT EXTERNAL ADDRESS
00793A 0CD4 30   02      A          LEAX   2,X
00794A 0CD6 AF   C8 3A   A          STX    XREFX,U
00795A 0CD9 17   04FC 11D8          LBSR   CRLF
00796A 0CDC 20   C8   0CA6          BRA    EX3
00797A 0CDE 39              EX2     RTS
00798                       *
00799                       *  PRINT LABEL
00800                       *
00801A 0CDF AE   44      A LABEL    LDX    CURLAB,U   CURRENT LABEL
00802A 0CE1 AE   02      A          LDX    2,X        ADDRESS OF LABEL
00803A 0CE3 AC   4F      A          CPX    REALPC,U   ARE WE THERE?
00804A 0CE5 22   1B   0D02          BHI    LABEL2
00805A 0CE7                         SETMSK 12
00806A 0CEB AE   44      A          LDX    CURLAB,U   CURRENT LABEL
00807A 0CED 17   022A 0F1A          LBSR   PRLAB      PRINT LABEL
00808A 0CF0 17   04A0 1193          LBSR   OUTSP      PRINT SPACE
00809A 0CF3                         SETMSK 11
00810A 0CF7 17   04D6 11D0          LBSR   OUTCHR     PRINT DASH IF NOT LABEL MODE
00811A 0CFA      2D      A          FCC    "-"
00812A 0CFB AE   44      A          LDX    CURLAB,U   BUMP TO NEXT LABEL
00813A 0CFD 30   06      A          LEAX   6,X
00814A 0CFF AF   44      A          STX    CURLAB,U
00815A 0D01 39                      RTS
00816                       *
00817                       *  DON'T PRINT LABEL
00818                       *
00819A 0D02 17   04E5 11EA LABEL2   LBSR   PASS2C     ONLY ON PASS 2
00820A 0D05                         SETMSK 12
00821A 0D09 17   047B 1187          LBSR   OUTSP5     SPACE OVER LABEL FIELD
00822A 0D0C 17   0484 1193          LBSR   OUTSP
00823A 0D0F                         SETMSK 11
00824A 0D13 16   047D 1193          LBRA   OUTSP      SPACE INSTEAD OF DASH
00825
00826                       *
00827                       *  PRINT RMB'S
00828                       *
00829A 0D16 17   0363 107C RMB      LBSR   DATCOL     PRINT DATA COLUMNS
00830A 0D19 8D   C4   0CDF          BSR    LABEL      PRINT THE LABEL
```

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00831A 0D1B                          SETMSK 13
00832A 0D1F 17   04BA 11DC           LBSR   PDATAI    PRINT "RMB"
00833A 0D22      52       A          FCC    /RMB  /
00834A 0D27      00       A          FCB    0
00835A 0D28 AE   44       A          LDX    CURLAB,U
00836A 0D2A EC   02       A          LDD    2,X        GET ADDRESS OF NEXT LABEL
00837A 0D2C 1F   01       A          TFR    D,X
00838A 0D2E A3   4F       A          SUBD   REALPC,U   GET BYTES TO NEXT LABEL
00839A 0D30 AF   4F       A          STX    REALPC,U   UPDATE PC TO NEXT LAB
00840A 0D32 1083 0009     A          CMPD   #9         MORE THAN SINGLE-DIGIT?
00841A 0D36 22   09    0D41          BHI    RMB4
00842A 0D38 1F   98       A          TFR    B,A
00843A 0D3A 8B   30       A          ADDA   #$30       MAKE NUMBER ASCII
00844A 0D3C 17   0456 1195           LBSR   OUTEE      PRINT IT
00845A 0D3F 20   0D    0D4E          BRA    RMB5
00846A 0D41 34   06       A RMB4     PSHS   D
00847A 0D43 17   048A 11D0           LBSR   OUTCHR     PRINT $ FOR HEX
00848A 0D46      24       A          FCC    '$'
00849A 0D47 1F   41                  TSX
00850A 0D49 17   0443 118F           LBSR   OUTADR     PRINT AS 4-DIGIT HEX
00851A 0D4C 32   62       A          LEAS   2,S
00852A 0D4E 16   0487 11D8 RMB5     LBRA   CRLF       NEW LINE AND LEAVE
00853                                *
00854                                *  PRINT SOURCE LINE
00855                                *
00856A 0D51 17   0496 11EA PRINTL    LBSR   PASS2C     ONLY ON PASS 2
00857A 0D54 8D   33    0D89          BSR    PRIMNE     PRINT MNEMONIC
00858A 0D56 6F   C8 52    A         CLR    LBF+18,U   FORCE END-OF-STRING
00859A 0D59 6D   C8 28    A         TST    FULLMD,U   ROOM FOR WHOLE LINE?
00860A 0D5C 26   03    0D61          BNE    PL2
00861A 0D5E 6F   C8 4B    A         CLR    LBF+11,U   END-OF-STR AFTER 11 CHARS
00862A 0D61 30   C8 40    A PL2      LEAX   LBF,U
00863A 0D64 17   047B 11E2           LBSR   PDATA      PRINT OPERAND FIELD
00864A 0D67                          SETMSK 15
00865A 0D6B 6D   C8 1C    A         TST    ALEN,U
00866A 0D6E 27   12    0D82          BEQ    PL4
00867A 0D70 AE   4B       A         LDX    PAC,U
00868A 0D72 A6   80       A         LDA    ,X+
00869A 0D74 17   03EC 1163           LBSR   OUTASC     PRINT ASCII EQUIVALENT
00870A 0D77 A6   C8 1C    A         LDA    ALEN,U
00871A 0D7A 4A                       DECA
00872A 0D7B 27   05    0D82          BEQ    PL4
00873A 0D7D A6   80       A         LDA    ,X+        GET NEXT BYTE
00874A 0D7F 17   03E1 1163           LBSR   OUTASC     PRINT ASCII
00875A 0D82                          SETMSK 13
00876A 0D86 16   044F 11D8           LBRA   CRLF       NEW LINE AND LEAVE
00877                                *
00878                                *  PRINT MNEMONIC
00879                                *
00880A 0D89                          PRIMNE SETMSK 13
00881A 0D8D E6   C8 1E    A         LDB    MNENO,U    MNEMONIC NUMBER
00882A 0D90 86   03       A         LDA    #3         THREE BYTES PER ENTRY
00883A 0D92 3D                       MUL               FORM INDEX
00884A 0D93 30   8D 09D4             LEAX   MNETAB,PCR
00885A 0D97 30   8B       A         LEAX   D,X        FORM ABSOLUTE POINTER
00886A 0D99 C6   03       A         LDB    #3         LENGTH OF MNEMONIC
00887A 0D9B A6   80       A PRNTL2   LDA    ,X+        GET A CHARACTER
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00888A 0D9D 17   03F5 1195          LBSR   OUTEE     PRINT IT
00889A 0DA0 5A                      DECB
00890A 0DA1 26   F8   0D9B          BNE    PRNTL2    LOOP FOR THREE
00891A 0DA3 A6   C8 1D   A          LDA    EXTRA,U   4th CHARACTER?
00892A 0DA6 26   02   0DAA          BNE    PRNTL3
00893A 0DA8 86   20      A          LDA    #$20      ELSE A SPACE
00894A 0DAA 17   03E8 1195 PRNTL3   LBSR   OUTEE     PRINT 4th CHARACTER
00895A 0DAD 16   03E3 1193          LBRA   OUTSP     SPACE AFTER MNEMONIC
00896                               *
00897                               *  GENERATE OPERAND FIELD
00898                               *
00899A 0DB0 86   20      A GENOPN   LDA    #$20      CLEAR LINE BUFFER
00900A 0DB2 31   C8 40   A          LEAY   LBF,U
00901A 0DB5 34   20      A          PSHS   Y
00902A 0DB7 31   C8 54   A          LEAY   ENDLBF,U
00903A 0DBA A7   A2      A GENOP2   STA    ,-Y
00904A 0DBC 10AC E4      A          CMPY   0,S
00905A 0DBF 26   F9   0DBA          BNE    GENOP2
00906A 0DC1 32   62      A          LEAS   2,S
00907A 0DC3 A7   C8 2B   A          STA    SAVEIT,U  SET NO OUTPUT
00908A 0DC6 A6   C8 36   A          LDA    INDFLG,U
00909A 0DC9 27   04   0DCF          BEQ    PRNTL4
00910A 0DCB 17   0402 11D0          LBSR   OUTCHR    PRINT INDIRECT BRKTS
00911A 0DCE      5B      A          FCB    '[
00912A 0DCF AE   C8 19   A PRNTL4   LDX    MODADR,U
00913A 0DD2 CC   0000    A          LDD    #0
00914A 0DD5 ED   C8 3C   A          STD    REFX,U
00915A 0DD8 AD   84      A          JSR    0,X       DO THE MODE ROUTINES
00916A 0DDA A6   C8 36   A          LDA    INDFLG,U
00917A 0DDD 27   04   0DE3          BEQ    PRNTL5
00918A 0DDF 17   03EE 11D0          LBSR   OUTCHR    END BRACKET INDIRECT
00919A 0DE2      5D      A          FCB    ']
00920A 0DE3 6F   C8 2B   A PRNTL5   CLR    SAVEIT,U  RESTORE PRINTING
00921A 0DE6 39                      RTS
00922                               *
00923                               *  PRINT TEXT STRING
00924                               *
00925A 0DE7 17   0292 107C FCC      LBSR   DATCOL    PRINT DATA COLUMNS
00926A 0DEA 17   FEF2 0CDF          LBSR   LABEL     PRINT LABEL
00927A 0DED                         SETMSK 13
00928A 0DF1 17   03E8 11DC          LBSR   PDATAI    PRINT "FCC"
00929A 0DF4      46      A          FCC    /FCC  /
00930A 0DF9      00      A          FCB    0
00931A 0DFA AE   44      A          LDX    CURLAB,U  NEXT LABEL
00932A 0DFC EC   02      A          LDD    2,X       DON'T GO PAST THIS ADR
00933A 0DFE A3   4F      A          SUBD   REALPC,U  MAX STRING SIZE
00934A 0E00 1083 0008    A          CMPD   #8        DON'T GO OVER 8
00935A 0E04 23   02   0E08          BLS    FCC2
00936A 0E06 C6   08      A          LDB    #8
00937A 0E08 6F   C8 1B   A FCC2     CLR    LENGTH,U
00938A 0E0B AE   4D      A          LDX    PRC,U     ACTUAL DATA ADDRESS
00939A 0E0D A6   80      A FCC3     LDA    ,X+       GET A BYTE
00940A 0E0F 81   20      A          CMPA   #$20      IS IT TEXT?
00941A 0E11 25   0A   0E1D          BLO    FCC4
00942A 0E13 81   7F      A          CMPA   #$7F
00943A 0E15 24   06   0E1D          BHS    FCC4
00944A 0E17 6C   C8 1B   A          INC    LENGTH,U  ONE MORE IN LENGTH
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00945A 0E1A 5A                          DECB            COUNT DOWN OUR 8
00946A 0E1B 26   F0   0E0D              BNE     FCC3
00947A 0E1D A6   C8 1B   A FCC4         LDA     LENGTH,U LENGTH OF FINAL STRING
00948A 0E20 8B   30       A             ADDA    #'0     MAKE ASCII
00949A 0E22 17   0370 1195              LBSR    OUTEE   PRINT IT
00950A 0E25 17   03A8 11D0              LBSR    OUTCHR  AND A COMMA
00951A 0E28      2C       A             FCC     ','
00952A 0E29 AE   4D       A             LDX     PRC,U
00953A 0E2B E6   C8 1B   A              LDB     LENGTH,U
00954A 0E2E A6   80       A FCC5        LDA     ,X+     GET A CHARACTER
00955A 0E30 17   0362 1195              LBSR    OUTEE   GUARANTEE PRINTABLE
00956A 0E33 5A                          DECB            COUNT DOWN
00957A 0E34 26   F8   0E2E              BNE     FCC5    AND LOOP
00958A 0E36 8D   03   0E3B              BSR     BUMPPC
00959A 0E38 16   039D 11D8              LBRA    CRLF
00960                           *
00961                           *  BUMP PC ADDRESS
00962                           *
00963A 0E3B E6   C8 1B   A BUMPPC LDB    LENGTH,U LENGTH OF LAST INSTRUCTION
00964A 0E3E 4F                          CLRA
00965A 0E3F E3   4F       A             ADDD    REALPC,U ADD TO LAST PC
00966A 0E41 24   03   0E46              BCC     BUMPP2
00967A 0E43 CC   FFFF     A             LDD     #$FFFF  HANG AT END OF MEM
00968A 0E46 ED   4F       A BUMPP2      STD     REALPC,U TO FORM NEW ONE
00969A 0E48 39                          RTS
00970                           *
00971                           *  LOOK UP AND INSERT SYMBOL TO TABLE
00972                           *
00973A 0E49 AE   C4       A LOOKUP      LDX     FIRLAB,U
00974A 0E4B 10A3 02       A             CMPD    2,X
00975A 0E4E 25   78   0EC8              BLO     LOOKX
00976A 0E50 AE   42       A             LDX     LASLAB,U
00977A 0E52 10A3 1C       A             CMPD    2-6,X
00978A 0E55 22   71   0EC8              BHI     LOOKX
00979                           *
00980                           *  INSERT TO LABEL TABLE (NOT EXT)
00981                           *
00982A 0E57 AE   42       A LOOKLA      LDX     LASLAB,U START AT END OF TABLE
00983A 0E59 34   06       A             PSHS    D       SAVE WHAT LOOKING FOR
00984A 0E5B AC   C4       A LOOKL7      CPX     FIRLAB,U DONE?
00985A 0E5D 27   23   0E82              BEQ     LOOKL4
00986A 0E5F 30   1A       A             LEAX    -6,X    MOVE TO NEXT LABEL
00987A 0E61 10A3 02       A             CMPD    2,X     CHECK IT OUT
00988A 0E64 25   F5   0E5B              BLO     LOOKL7  NOT THERE YET?
00989A 0E66 27   71   0ED9              BEQ     SETBIT  FOUND IT?
00990A 0E68 30   06       A             LEAX    6,X     OVERSHOT
00991A 0E6A AF   C8 34   A              STX     XT,U
00992A 0E6D AE   42       A             LDX     LASLAB,U
00993A 0E6F AC   C8 34   A LOOKL5       CPX     XT,U
00994A 0E72 27   0E   0E82              BEQ     LOOKL4
00995A 0E74 EC   83       A             LDD     ,--X    MOVE LABELS
00996A 0E76 ED   06       A             STD     6,X
00997A 0E78 EC   83       A             LDD     ,--X
00998A 0E7A ED   06       A             STD     6,X
00999A 0E7C EC   83       A             LDD     ,--X
01000A 0E7E ED   06       A             STD     6,X
01001A 0E80 20   ED   0E6F              BRA     LOOKL5
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01002A 0E82 EC   42       A LOOKL4 LDD    LASLAB,U END OF TABLE
01003A 0E84 C3   0006     A        ADDD   #6       BUMP BY ONE LABEL
01004A 0E87 ED   42       A        STD    LASLAB,U
01005A 0E89 A6   1A       A        LDA    -6,X
01006A 0E8B 84   7F       A        ANDA   #$7F
01007A 0E8D A7   84       A        STA    0,X
01008A 0E8F 35   06       A        PULS   D
01009
01010                       *
01011                       *  STORE NEW SYMBOL & CHECK OVERFLOW
01012                       *
01013A 0E91 ED   02       A LOOKL6 STD    2,X      SAVE ADDRESS
01014A 0E93 6F   04       A        CLR    4,X      NO XREF
01015A 0E95 6F   05       A        CLR    5,X
01016A 0E97 6F   01       A        CLR    1,X      NO BYTE 1
01017A 0E99 EC   42       A        LDD    LASLAB,U
01018A 0E9B 10A3 46       A        CMPD   BOTEXT,U
01019A 0E9E 24   06   0EA6        BHS    OVERR    TABLES RAN INTO EACH OTHER?
01020A 0EA0 AF   C8 17    A        STX    LOOKXT,U
01021A 0EA3 A6   84       A        LDA    0,X
01022A 0EA5 39                     RTS
01023A 0EA6                 OVERR  STRG   (SYMBOL  TABLE OV.  N.E.R.F.),RET
01024A 0EC5 16   FB26 09EE        LBRA   BRAK     GO DO A BREAK
01025
01026                       *
01027                       *  LOOK UP EXTERNAL
01028                       *
01029A 0EC8 AE   48       A LOOKX  LDX    TOPEXT,U
01030A 0ECA AC   46       A LOOKX2 CPX    BOTEXT,U
01031A 0ECC 27   16   0EE4        BEQ    LOOKX3
01032A 0ECE 30   1A       A        LEAX   -6,X
01033A 0ED0 10A3 02       A        CMPD   2,X
01034A 0ED3 25   F5   0ECA        BLO    LOOKX2
01035A 0ED5 22   1D   0EF4        BHI    LOOKX4
01036A 0ED7 34   06       A        PSHS   D
01037A 0ED9 A6   84       A SETBIT LDA    0,X
01038A 0EDB A7   C8 33    A        STA    ECFLAG,U
01039A 0EDE 8A   80       A        ORA    #$80     BIT MEANS "SEEN BEFORE"
01040A 0EE0 A7   84       A        STA    0,X
01041A 0EE2 35   86       A        PULS   D,PC
01042A 0EE4 AE   46       A LOOKX3 LDX    BOTEXT,U
01043A 0EE6 30   1A       A        LEAX   -6,X
01044A 0EE8 AF   46       A        STX    BOTEXT,U
01045A 0EEA 34   02       A LOOKX6 PSHS   A
01046A 0EEC 86   58       A        LDA    #'X      TYPE "EXTERNAL"
01047A 0EEE A7   84       A        STA    0,X
01048A 0EF0 35   02       A        PULS   A
01049A 0EF2 20   9D   0E91        BRA    LOOKL6
01050                       *
01051                       *  MOVE EXTERNALS DOWN
01052                       *
01053A 0EF4 AF   C8 17    A LOOKX4 STX    LOOKXT,U
01054A 0EF7 AE   46       A        LDX    BOTEXT,U
01055A 0EF9 30   1A       A        LEAX   -6,X
01056A 0EFB AF   46       A        STX    BOTEXT,U
01057A 0EFD 34   06       A        PSHS   D
01058A 0EFF EC   06       A LOOKX5 LDD    6,X      MOVE THE DATA
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01059A 0F01 ED   81      A        STD    ,X++
01060A 0F03 AC   C8 17   A        CPX    LOOKXT,U
01061A 0F06 26   F7  0EFF         BNE    LOOKX5
01062A 0F08 35   06      A        PULS   D
01063A 0F0A 20   DE  0EEA         BRA    LOOKX6
01064                      *
01065                      *  REFERENCE SYMBOL
01066                      *
01067                      *  ENTRIES - REFERN (D SET) AND PRLAB (X SET)
01068                      *
01069A 0F0C 17   FF3A 0E49 REFERN LBSR   LOOKUP   FIND SYMBOL
01070A 0F0F 17   02D8 11EA        LBSR   PASS2C   DON'T PRINT PASS 1
01071A 0F12 EC   04      A        LDD    4,X
01072A 0F14 ED   C8 23   A        STD    LASREF,U SAVE LAST REFERENCE
01073A 0F17 AF   C8 3C   A        STX    REFX,U
01074A 0F1A A6   84      A PRLAB  LDA    0,X      GET TYPE
01075A 0F1C 84   7F      A        ANDA   #$7F     REMOVE FLAG BIT
01076A 0F1E 17   0274 1195        LBSR   OUTEE    PRINT IT
01077A 0F21 30   02      A        LEAX   2,X
01078A 0F23 17   024B 1171        LBSR   OUTBYT   PRINT ADDRESS
01079A 0F26 16   0248 1171        LBRA   OUTBYT
01080                      *
01081                      *  CHANGE MODE 0 TO INDEXED MODE 1..n
01082                      *
01083A 0F29 AE   4B      A MODE0  LDX    PAC,U    GET OPCODE ADR
01084A 0F2B A6   01      A        LDA    1,X      POSTBYTE
01085A 0F2D 84   60      A        ANDA   #$60     REGISTER BITS
01086A 0F2F 30   8D 0029          LEAX   XYUS-1,PCR REGISTER TABLE
01087A 0F33 30   01        MODE01 INX
01088A 0F35 80   20      A        SUBA   #$20
01089A 0F37 2A   FA  0F33         BPL    MODE01   LOOP FOR MULTIPLY
01090A 0F39 A6   84      A        LDA    X        GET THE ENTRY
01091A 0F3B A7   C8 37   A        STA    INDREG,U SAVE IT
01092A 0F3E AE   4B      A        LDX    PAC,U
01093A 0F40 A6   01      A        LDA    1,X      GET POSTBYTE AGAIN
01094A 0F42 2A   13  0F57         BPL    MODE02   IF PLUS, 5-BIT MODE
01095A 0F44 84   10      A        ANDA   #$10     INDIRECT BIT
01096A 0F46 A7   C8 36   A        STA    INDFLG,U
01097A 0F49 A6   01      A        LDA    1,X      GET IT ONCE MORE
01098A 0F4B 84   1F      A        ANDA   #$1F     MODE TYPE BITS
01099A 0F4D 30   8D 04AC          LEAX   PBTAB,PCR
01100A 0F51 A6   86      A        LDA    A,X      GET MODE NUMBER
01101A 0F53 A7   C8 16   A        STA    MODE,U   SAVE THE NEW MODE
01102A 0F56 39                    RTS
01103A 0F57 86   01      A MODE02 LDA    #1
01104A 0F59 A7   C8 16   A        STA    MODE,U   5-BIT MODE = #1
01105A 0F5C 39                    RTS
01106                      *
01107A 0F5D      58      A XYUS   FCC    /XYUS/
01108
01109                      *
01110                      *  LOOK UP OPCODE
01111                      *
01112A 0F61 AE   4D      A LOOKOP LDX    PRC,U
01113A 0F63 AF   4B      A        STX    PAC,U    SET TO NO PREBYTE
01114A 0F65 6F   C8 36   A        CLR    INDFLG,U NO INDIRECT YET
01115A 0F68 6F   C8 1D   A        CLR    EXTRA,U  NO EXTRA LETTER YET
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01116A OF6B A6   C8 38    A          LDA    DAREA,U   DATA AREA?
01117A OF6E 81   53       A          CMPA   #'S
01118A OF70 27   OF   OF81           BEQ    ISAD      TREAT STRING AS FCB
01119A OF72 81   54       A          CMPA   #'T
01120A OF74 26   07   OF7D           BNE    NOTAT     NOT TABLE
01121A OF76 6D   C8 14    A          TST    TFLAG,U
01122A OF79 27   06   OF81           BEQ    ISAD      TREAT TABLE AS FCB
01123A OF7B 20   19   OF96           BRA    ISANA     OR AS FDB
01124                     *
01125A OF7D 81   44       A NOTAT    CMPA   #'D
01126A OF7F 26   11   OF92           BNE    NODA
01127A OF81 86   01       A ISAD     LDA    #1
01128A OF83 A7   C8 14    A          STA    TFLAG,U
01129A OF86 86   18       A          LDA    #DATMOD
01130A OF88 A7   C8 16    A          STA    MODE,U
01131A OF8B 86   50       A          LDA    #80       "FCB"
01132A OF8D A7   C8 1E    A          STA    MNENO,U   MNEMONIC NO.
01133A OF90 20   40   OFD2           BRA    NOTMO
01134                     *
01135A OF92 81   41       A NODA     CMPA   #'A
01136A OF94 26   OF   OFA5           BNE    NOD
01137A OF96 6F   C8 14    A ISANA    CLR    TFLAG,U
01138A OF99 86   1A       A          LDA    #ADDMOD
01139A OF9B A7   C8 16    A          STA    MODE,U
01140A OF9E 86   55       A          LDA    #85       FDB MNEMONIC
01141A OFA0 A7   C8 1E    A          STA    MNENO,U
01142A OFA3 20   2D   OFD2           BRA    NOTMO
01143                     *
01144A OFA5 A6   84       A NOD      LDA    X
01145A OFA7 81   10       A          CMPA   #$10      PREBYTE?
01146A OFA9 27   5B   1006           BEQ    OP10
01147A OFAB 81   11       A          CMPA   #$11      OTHER ONE?
01148A OFAD 26   06   OFB5           BNE    NO11
01149A OFAF 30   8D 094E             LEAX   BYTE11-4,PCR
01150A OFB3 20   55   100A           BRA    OP1011
01151A OFB5 C6   03       A NO11     LDB    #3
01152A OFB7 3D                      MUL
01153A OFB8 30   8D 04AF           LEAX   BIGTAB,PCR
01154A OFBC 30   8B       A          LEAX   D,X
01155A OFBE A6   84       A RTAB     LDA    0,X
01156A OFC0 A7   C8 1E    A          STA    MNENO,U   MNEMONIC NO.
01157A OFC3 A6   02       A          LDA    2,X
01158A OFC5 A7   C8 1D    A          STA    EXTRA,U   LETTER AT END
01159A OFC8 A6   01       A          LDA    1,X
01160A OFCA A7   C8 16    A          STA    MODE,U
01161A OFCD 26   03   OFD2           BNE    NOTMO
01162A OFCF 17   FF57 OF29          LBSR   MODE0
01163A OFD2 A6   C8 16    A NOTMO    LDA    MODE,U
01164A OFD5 81   19       A          CMPA   #ERMODE
01165A OFD7 26   0F   OFE8           BNE    NOTMO2
01166A OFD9 C6   50       A          LDB    #80       FDB MNEMONIC
01167A OFDB E7   C8 1E    A          STB    MNENO,U
01168A OFDE 6F   C8 36    A          CLR    INDFLG,U
01169A OFE1 6F   C8 1D    A          CLR    EXTRA,U
01170A OFE4 AE   4D       A          LDX    PRC,U
01171A OFE6 AF   4B       A          STX    PAC,U
01172A OFE8 4A                      NOTMO2 DECA
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01173A OFE9 C6   03       A          LDB    #3        THREE PER ENTRY
01174A OFEB 3D                      MUL
01175A OFEC 30   8D 042D            LEAX   MODTAB,PCR
01176A OFF0 30   8B       A         LEAX   D,X       FORM ADDRESS OF ENTRY
01177A OFF2 A6   02       A         LDA    2,X
01178A OFF4 A7   C8 1C    A         STA    ALEN,U
01179A OFF7 AB   4C       A         ADDA   PAC+1,U
01180A OFF9 A0   4E       A         SUBA   PRC+1,U
01181A OFFB A7   C8 1B    A         STA    LENGTH,U
01182A OFFE EC   84       A         LDD    0,X
01183A 1000 30   8B       A         LEAX   D,X
01184A 1002 AF   C8 19    A         STX    MODADR,U
01185A 1005 39                      RTS
01186                         *
01187                         *  FIND OPCODE AFTER PREBYTE
01188                         *
01189A 1006 30   8D 085F    OP10    LEAX   BYTE10-4,PCR
01190A 100A AF   C8 34    A OP1011  STX    XT,U
01191A 100D AE   4D       A         LDX    PRC,U
01192A 100F 30   01                  INX              MOVE PAST PREBYTE
01193A 1011 AF   4B       A         STX    PAC,U
01194A 1013 A6   84       A         LDA    X
01195A 1015 AE   C8 34    A         LDX    XT,U
01196A 1018 30   04       A OP1012  LEAX   4,X       MOVE TO NEXT ENTRY
01197A 101A A1   84       A         CMPA   X         IS IT?
01198A 101C 22   FA    1018        BHI    OP1012    LOOP
01199A 101E 25   04    1024        BLO    OPNG      NOT THERE
01200A 1020 30   01                  INX              POINT TO TABLE ENTRY
01201A 1022 20   9A    OFBE        BRA    RTAB      AND GO TREAT LIKE NORMAL
01202A 1024 30   8D 0473   OPNG    LEAX   $10*3+BIGTAB,PCR
01203A 1028 20   94    OFBE        BRA    RTAB
01204                         *
01205                         *  PRINT EQU *-n
01206                         *
01207A 102A AE   44       A EQUS    LDX    CURLAB,U
01208A 102C EC   4F       A         LDD    REALPC,U SAVE PC ON STACK
01209A 102E 34   06       A         PSHS   D
01210A 1030 A3   02       A         SUBD   2,X       CALCULATE DIFFERENCE
01211A 1032 E7   C8 32    A         STB    DIF,U
01212A 1035 AE   02       A         LDX    2,X
01213A 1037 AF   4F       A         STX    REALPC,U FAKE LAST PC
01214A 1039 8D   41    107C        BSR    DATCOL    PRINT DATA COLUMNS
01215A 103B 35   06       A         PULS   D
01216A 103D ED   4F       A         STD    REALPC,U RESTORE PC
01217A 103F 17   FC9D OCDF         LBSR   LABEL     PRINT LABEL
01218A 1042                         SETMSK 13
01219A 1046 17   0193 11DC          LBSR   PDATAI
01220A 1049      45       A         FCC    /EQU  *-/
01221A 1050      00       A         FCB    0
01222A 1051 A6   C8 32    A         LDA    DIF,U     GET DIFFERENCE
01223A 1054 8D   03    1059        BSR    OUTSM     OUTPUT SMALL NUMBER
01224A 1056 16   017F 11D8          LBRA   CRLF
01225                         *
01226                         *  OUTPUT SMALL NUMBER
01227                         *
01228A 1059 4D                      OUTSM  TSTA
01229A 105A 2A   09    1065        BPL    OUTSM3    IS IT POSITIVE?
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01230A 105C 34   02                PSHA
01231A 105E 17   016F 11D0         LBSR   OUTCHR    PRINT MINUS SIGN
01232A 1061      2D       A        FCB    '-
01233A 1062 35   02                PULA
01234A 1064 40                     NEGA
01235A 1065 81   09       A OUTSM3 CMPA   #9        SINGLE DIGIT?
01236A 1067 22   05    106E        BHI    OUTSM2
01237A 1069 8B   30       A        ADDA   #$30      MAKE ASCII
01238A 106B 16   0127 1195         LBRA   OUTEE
01239A 106E 34   02          OUTSM2 PSHA
01240A 1070 17   015D 11D0         LBSR   OUTCHR    PRINT AS HEX
01241A 1073      24       A        FCB    '$
01242A 1074 1F   41                TSX
01243A 1076 17   00F8 1171         LBSR   OUTBYT
01244A 1079 35   02                PULA
01245A 107B 39                     RTS
01246
01247                              ********************************************
01248                              *
01249                              *  PRINT DATA LINE
01250                              *
01251A 107C 6F   C8 1B    A DATCOL CLR    LENGTH,U
01252A 107F CC   0000      A        LDD    #0
01253A 1082 ED   C8 3C    A        STD    REFX,U
01254A 1085 17   0162 11EA PRDATC LBSR    PASS2C
01255A 1088                        SETMSK 0
01256A 108C 6D   C8 2E    A        TST    STARS,U   DO WE FLAG THIS LINE?
01257A 108F 26   07    1098        BNE    STARS1
01258A 1091 30   4F       A        LEAX   REALPC,U  ADDRESS OF PC
01259A 1093 17   00F9 118F         LBSR   OUTADR    PRINT PC
01260A 1096 20   09    10A1        BRA    STARS2
01261A 1098 17   0141 11DC STARS1 LBSR    PDATAI    PRINT STARS INSTEAD
01262A 109B      2A       A        FCC    /**** /
01263A 10A0      00       A        FCB    0
01264            10A1     A STARS2 EQU    *
01265                              *
01266                              *  PREBYTE
01267                              *
01268A 10A1                        SETMSK 1
01269A 10A5 A6   C8 1B    A        LDA    LENGTH,U
01270A 10A8 81   05       A        CMPA   #5        NEED PREBYTE FIELD?
01271A 10AA 25   07    10B3        BLO    FMT1
01272A 10AC AE   4D       A        LDX    PRC,U
01273A 10AE 17   00C0 1171         LBSR   OUTBYT    PRINT PREBYTE
01274A 10B1 20   03    10B6        BRA    FMT2
01275A 10B3 17   00D5 118B FMT1    LBSR   OUTSP2    ELSE SPACE OVER FIELD
01276            10B6     A FMT2    EQU    *
01277                              *
01278                              *  HEX VALUE
01279                              *
01280A 10B6                        SETMSK 2
01281A 10BA E6   C8 1B    A        LDB    LENGTH,U
01282A 10BD AE   4D       A        LDX    PRC,U
01283A 10BF C1   05       A        CMPB   #5        PREBYTE ALREADY?
01284A 10C1 25   03    10C6        BLO    FMT3
01285A 10C3 30   01                INX              SKIP PREBYTE
01286A 10C5 5A                     DECB
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01287A 10C6 8D   0C   10D4 FMT3   BSR    BOS       PRINT BYTE OR SPACE
01288A 10C8 8D   0A   10D4        BSR    BOS       AND THE NEXT ONE
01289A 10CA                      SETMSK 3
01290A 10CE 8D   04   10D4        BSR    BOS       OTHERS IN MASK 3 ONLY
01291A 10D0 8D   02   10D4        BSR    BOS
01292A 10D2 20   0A   10DE        BRA    FMT4
01293                            *
01294                            *  ONE BYTE OR SPACE
01295                            *
01296A 10D4 5D                   BOS    TSTB              LENGTH COUNT GONE?
01297A 10D5 2F   04   10DB        BLE    BOS2      PRINT SPACE IF SO
01298A 10D7 5A                   DECB              COUNT DOWN BYTES
01299A 10D8 16   0096 1171        LBRA   OUTBYT    PRINT THE BYTE
01300A 10DB 16   00AD 118B BOS2   LBRA   OUTSP2
01301                            *
01302                            *  HEX EXTRA MARKER
01303                            *
01304A 10DE                      FMT4   SETMSK 4
01305A 10E2 86   20       A      LDA    #$20
01306A 10E4 E6   C8 1B    A      LDB    LENGTH,U  LENGTH OF INSTR
01307A 10E7 C1   02       A      CMPB   #2        IF >2, DIDN'T FIT
01308A 10E9 2F   02   10ED      BLE    FMT5
01309A 10EB 86   2B       A      LDA    #'+       MARK LEFTOVERS
01310A 10ED 17   00A5 1195 FMT5   LBSR   OUTEE
01311                            *
01312                            *  REFERENCE ADDRESS
01313                            *
01314A 10F0                      SETMSK 8
01315A 10F4 17   009C 1193       LBSR   OUTSP
01316A 10F7                      SETMSK 5
01317A 10FB AE   C8 3C    A      LDX    REFX,U
01318A 10FE 27   30   1130      BEQ    FMT6      NOT MEMORY REF?
01319A 1100 30   02       A      LEAX   2,X
01320A 1102 17   008A 118F      LBSR   OUTADR    PRINT ADDR OF LABEL
01321A 1105                      SETMSK 6
01322A 1109 AE   C8 23    A      LDX    LASREF,U
01323A 110C 27   07   1115      BEQ    FMT8
01324A 110E 30   C8 23    A      LEAX   LASREF,U  POINT AT XREF
01325A 1111 8D   7C   118F      BSR    OUTADR    AND PRINT XREF COL
01326A 1113 20   12   1127      BRA    FMT9
01327A 1115 6D   C8 33    A FMT8   TST    ECFLAG,U  END-OF-CHAIN?
01328A 1118 2A   0B   1125      BPL    FMT12
01329A 111A 17   00BF 11DC      LBSR   PDATAI
01330A 111D      2E       A      FCC    /.... /
01331A 1122      00       A      FCB    0
01332A 1123 20   02   1127      BRA    FMT9
01333A 1125 8D   60   1187 FMT12  BSR    OUTSP5
01334A 1127 AE   C8 3C    A FMT9   LDX    REFX,U
01335A 112A EC   4F       A      LDD    REALPC,U
01336A 112C ED   04       A      STD    4,X       SAVE NEW XREF
01337A 112E 20   08   1138      BRA    FMT7
01338A 1130 8D   55   1187 FMT6   BSR    OUTSP5
01339A 1132                      SETMSK 6
01340A 1136 8D   4F   1187       BSR    OUTSP5
01341            1138    A FMT7   EQU    *
01342                            *
01343                            *  FIVE CHARACTER ASCII
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01344                                *
01345A 1138                          SETMSK 7
01346A 113C 8D   55   1193           BSR    OUTSP
01347A 113E AE   4D      A           LDX    PRC,U
01348A 1140 5F                       CLRB
01349A 1141 86   20      A FMT10     LDA    #$20       SPACE IF PAST END
01350A 1143 E1   C8 1B   A           CMPB   LENGTH,U   PAST END OF INSTR?
01351A 1146 2C   02   114A          BGE    FMT11
01352A 1148 A6   80      A           LDA    ,X+        GET MORE DATA IF THERE
01353A 114A 8D   17   1163 FMT11     BSR    OUTASC     PRINT IF PRINTABLE
01354A 114C 5C                       INCB
01355A 114D C1   05      A           CMPB   #5         END OF COLUMN?
01356A 114F 25   F0   1141           BLO    FMT10
01357                                *
01358A 1151 6D   C8 2C   A           TST    COL80,U    DON'T CR ON 80 COLUMNS
01359A 1154 26   06   115C          BNE    FMT13
01360A 1156                          SETMSK 9          ONLY IN FULL MODE
01361A 115A 8D   7C   11D8          BSR    CRLF       CARRIAGE RETURN HERE
01362A 115C                     FMT13 SETMSK 10
01363A 1160 8D   31   1193          BSR    OUTSP
01364A 1162 39                       RTS
01365                                *
01366                                *  PRINT ASCII EQUIVALENT
01367                                *
01368A 1163 84   7F      A OUTASC    ANDA   #$7F       FORGET PARITY
01369A 1165 81   7F      A           CMPA   #$7F       IS IT RUBOUT?
01370A 1167 27   04   116D          BEQ    OUTAS3
01371A 1169 81   20      A           CMPA   #$20       PRINTABLE?
01372A 116B 2C   02   116F          BGE    OUTAS2
01373A 116D 86   2E      A OUTAS3    LDA    #'.        USE PERIOD IF CAN'T PRINT
01374A 116F 20   24   1195 OUTAS2    BRA    OUTEE
01375
01376                                ************************************************
01377                                *                                              *
01378                                *  PRINTER OUTPUT UTILITY ROUTINES             *
01379                                *                                              *
01380                                ************************************************
01381
01382                                *
01383                                *  PRINT BYTE
01384                                *
01385A 1171 A6   84      A OUTBYT    LDA    0,X
01386A 1173 47                       ASRA
01387A 1174 47                       ASRA
01388A 1175 47                       ASRA
01389A 1176 47                       ASRA
01390A 1177 8D   02   117B          BSR    OUTNY
01391A 1179 A6   80      A           LDA    ,X+
01392A 117B 84   0F      A OUTNY     ANDA   #$F
01393A 117D 81   09      A           CMPA   #9
01394A 117F 23   02   1183          BLS    OUTNY2
01395A 1181 8B   07      A           ADDA   #7
01396A 1183 8B   30      A OUTNY2    ADDA   #$30
01397A 1185 20   0E   1195          BRA    OUTEE
01398                                *
01399                                *  PRINT SPACES
01400                                *
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01401A 1187 8D   0A   1193 OUTSP5 BSR    OUTSP
01402A 1189 8D   00   118B         BSR    OUTSP2
01403A 118B 8D   06   1193 OUTSP2 BSR    OUTSP
01404A 118D 20   04   1193         BRA    OUTSP
01405                     *
01406                     *  PRINT ADDRESS AND SPACE
01407                     *
01408A 118F 8D   E0   1171 OUTADR BSR    OUTBYT
01409A 1191 8D   DE   1171         BSR    OUTBYT
01410A 1193 86   20      A OUTSP  LDA    #$20
01411                     *        FALL THRU
01412                     *
01413                     *  OUTPUT ONE CHARACTER TO PRINTER
01414                     *
01415A 1195 8D   53   11EA OUTEE  BSR    PASS2C   DON'T PRINT 1ST PASS
01416A 1197 6D   C8 2B   A         TST    SAVEIT,U NOT PRINTING?
01417A 119A 26   31   11CD        BNE    TOY
01418A 119C 34   06      A        PSHS   D
01419A 119E EC   C8 2F   A         LDD    MASKF,U  FIELD MASK
01420A 11A1 A4   C8 25   A         ANDA   CURMSK,U IS THAT BIT SET IN CURRENT
01421A 11A4 26   03   11A9        BNE    OUTEE2
01422A 11A6 E4   C8 26   A         ANDB   CURMSK+1,U TRY OTHER BYTE
01423A 11A9 35   06      A OUTEE2 PULS   D
01424A 11AB 27   22   11CF        BEQ    OUTEE3   IF ZERO, DON'T PRINT
01425A 11AD 6C   C8 31   A         INC    COLCNT,U COUNT COLUMNS
01426A 11B0 81   0D      A        CMPA   #$D      CARRIAGE RETURN?
01427A 11B2 26   11   11C5        BNE    OUTEE4
01428A 11B4 A6   C8 31   A         LDA    COLCNT,U
01429A 11B7 6F   C8 31   A         CLR    COLCNT,U RESET COUNTER
01430A 11BA 81   21      A        CMPA   #33      AT END OF LINE?
01431A 11BC 26   05   11C3        BNE    OUTEE5
01432A 11BE 6D   C8 27   A         TST    NOCR32,U FORGET THE CR?
01433A 11C1 26   0C   11CF        BNE    OUTEE3
01434A 11C3 86   0D      A OUTEE5 LDA    #$D
01435A 11C5 6D   C8 2D   A OUTEE4 TST    PRINTR,U ARE WE PRINTING
01436A 11C8 27   2E   11F8        BEQ    TOUCH    TO SCREEN INSTEAD?
01437A 11CA 16   F43D 060A        LBRA   OUTPRT   TO RS232
01438                     *
01439                     *  SAVE CHARACTER IN BUFFER
01440                     *
01441A 11CD A7   A0      A TOY    STA    ,Y+
01442A 11CF 39            OUTEE3 RTS
01443                     *
01444                     *  OUTPUT ONE CHARACTER INLINE
01445                     *
01446A 11D0 35   10      A OUTCHR PULS   X
01447A 11D2 A6   80      A        LDA    ,X+      GET THE CHARACTER
01448A 11D4 8D   BF   1195        BSR    OUTEE    PRINT IT
01449A 11D6 6E   84      A        JMP    0,X      RETURN PAST PARAMETER
01450                     *
01451                     *  CARRIAGE RET / LINE FEED
01452                     *
01453A 11D8 86   0D      A CRLF   LDA    #$D      NOT HARD, IS IT
01454A 11DA 20   B9   1195        BRA    OUTEE
01455                     *
01456                     *  PRINT DATA TO PRINTER OR SCREEN
01457                     *
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01458A 11DC 35   10      A PDATAI PULS   X          USE RET ADDR AS PTR
01459A 11DE 8D   02  11E2         BSR    PDATA      PRINT IN-LINE DATA
01460A 11E0 6E   84      A        JMP    0,X        RETURN PAST STRING
01461                          *
01462A 11E2 A6   80      A PDATA  LDA    ,X+        GET A CHARACTER
01463A 11E4 27   0B  11F1         BEQ    PAS2C1     IF ZERO, LEAVE
01464A 11E6 8D   AD  1195         BSR    OUTEE      PRINT IT
01465A 11E8 20   F8  11E2         BRA    PDATA      AND LOOP
01466                          *
01467                          *  ONLY ON PASS 2
01468                          *
01469A 11EA 6D   C8 11   A PASS2C TST    PASS,U
01470A 11ED 26   02  11F1         BNE    PAS2C1
01471A 11EF 32   62      A        LEAS   2,S        PULL 1ST RET ADDR
01472A 11F1 39                 PAS2C1 RTS
01473
01474                          ************************************************
01475                          *
01476                          *  DISPLAY TO SCREEN
01477                          *
01478A 11F2 AE   E1      A INDIS  LDX    ,S++       USE RETURN ADDRESS
01479A 11F4 8D   16  120C         BSR    DISPLA     AS STRING POINTER
01480A 11F6 6E   84      A        JMP    0,X        AND RETURN PAST STRING
01481                          *
01482A 11F8 6D   C8 2A   A TOUCH  TST    SLOW,U     ARE WE IN SLOW MODE?
01483A 11FB 27   0C  1209         BEQ    TOUCH3     IF NOT, GO AHEAD
01484A 11FD 34   10      A        PSHS   X
01485A 11FF AE   8D F412          LDX    SCON,PCR   SLOW SPEED CONSTANT
01486A 1203 30   1F             TOUCH2 DEX            COUNT FOR DELAY
01487A 1205 26   FC  1203         BNE    TOUCH2
01488A 1207 35   10      A        PULS   X
01489A 1209 16   F3FA 0606     TOUCH3 LBRA   OUTCH
01490                          *
01491A 120C A6   80      A DISPLA LDA    ,X+        GET THE CHARACTER
01492A 120E 27   E1  11F1         BEQ    PAS2C1     END OF STRING?
01493A 1210 8D   E6  11F8         BSR    TOUCH      TO ROM ROUTINE
01494A 1212 20   F8  120C         BRA    DISPLA
01495
01496                          ************************************************
01497                          *                                              *
01498                          *  CALCULATE ADDRESSING MODE OUTPUT            *
01499                          *                                              *
01500                          ************************************************
01501
01502                          *
01503                          *  INDEXED ADDRESSING MODES
01504                          *
01505A 1214 AE   4B      A MODE1  LDX    PAC,U      5,R
01506A 1216 A6   01      A        LDA    1,X
01507A 1218 48                    ASLA
01508A 1219 48                    ASLA
01509A 121A 48                    ASLA
01510A 121B 47                    ASRA
01511A 121C 47                    ASRA
01512A 121D 47                    ASRA
01513A 121E 17   FE38 1059 MOD18  LBSR   OUTSM
01514A 1221 8D   AD   11D0 COMMAR BSR    OUTCHR
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01515A 1223       2C       A          FCB     ',
01516A 1224 A6    C8 37    A          LDA     INDREG,U
01517A 1227 16    FF6B 1195           LBRA    OUTEE
01518                         *
01519A 122A 8D    F5   1221 MODE2      BSR     COMMAR    ,R+
01520A 122C 86    2B       A MOD23     LDA     #'+
01521A 122E 16    FF64 1195           LBRA    OUTEE
01522                         *
01523A 1231 8D    F7   122A MODE3      BSR     MODE2     ,R++
01524A 1233 20    F7   122C           BRA     MOD23
01525                         *
01526A 1235 86    2C       A MODE4     LDA     #',
01527A 1237 17    FF5B 1195 MODE45     LBSR    OUTEE
01528A 123A 86    2D       A          LDA     #'-
01529A 123C 17    FF56 1195           LBSR    OUTEE
01530A 123F A6    C8 37    A          LDA     INDREG,U
01531A 1242 16    FF50 1195           LBRA    OUTEE
01532                         *
01533A 1245 86    2C       A MODE5     LDA     #',       ,--R
01534A 1247 17    FF4B 1195           LBSR    OUTEE
01535A 124A 86    2D       A          LDA     #'-
01536A 124C 20    E9   1237           BRA     MODE45
01537                         *
01538A 124E 86    30       A MODE6     LDA     #'0       0,R
01539A 1250 17    FF42 1195 MODE67     LBSR    OUTEE
01540A 1253 20    CC   1221           BRA     COMMAR
01541                         *
01542A 1255 86    42       A MODE7     LDA     #'B       B,R
01543A 1257 20    F7   1250           BRA     MODE67
01544                         *
01545A 1259 86    41       A MODE8     LDA     #'A       A,R
01546A 125B 20    F3   1250           BRA     MODE67
01547                         *
01548A 125D AE    4B       A MODE9     LDX     PAC,U     8,R
01549A 125F A6    02       A          LDA     2,X
01550A 1261 20    BB   121E           BRA     MOD18
01551                         *
01552A 1263 AE    4B       A MODE10    LDX     PAC,U     16,R
01553A 1265 EC    02       A          LDD     2,X
01554A 1267 17    FCA2 0F0C           LBSR    REFERN
01555A 126A 20    B5   1221           BRA     COMMAR
01556                         *
01557A 126C 86    44       A MODE11    LDA     #'D       D,R
01558A 126E 20    E0   1250           BRA     MODE67
01559                         *
01560A 1270 17    FF5D 11D0 MODE12     LBSR    OUTCHR
01561A 1273       3C       A          FCC     '<'
01562A 1274 AE    4B       A          LDX     PAC,U
01563A 1276 E6    02       A          LDB     2,X
01564A 1278 1D                        SEX
01565A 1279 E3    4F       A MOD24     ADDD    REALPC,U
01566A 127B EB    C8 1B    A          ADDB    LENGTH,U
01567A 127E 89    00       A          ADCA    #0
01568A 1280 8D    17   1299           BSR     TREFQ
01569A 1282 17    FF57 11DC           LBSR    PDATAI
01570A 1285       2C       A          FCC     /,PCR/
01571A 1289       00       A          FCB     0
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01572A 128A 39                      RTS
01573                           *
01574A 128B 17   FF42 11D0 MODE13 LBSR   OUTCHR   16,PC
01575A 128E      3E      A        FCC    '>'
01576A 128F AE   4B      A        LDX    PAC,U
01577A 1291 EC   02      A        LDD    2,X
01578A 1293 20   E4   1279        BRA    MOD24
01579                           *
01580A 1295 AE   4B      A MODE14 LDX    PAC,U     [ABS IND]
01581A 1297 EC   02      A        LDD    2,X
01582A 1299 16   FC70 0F0C TREFQ  LBRA   REFERN
01583
01584                           *
01585                           *  NON-INDEXED ADDRESSING MODES
01586                           *
01587A 129C 39                  MODE15 RTS              INHERENT
01588                           *
01589A 129D AE   4B      A MODE16 LDX    PAC,U     PSH/PUL
01590A 129F A6   84      A        LDA    X
01591A 12A1 84   02      A        ANDA   #2
01592A 12A3 A7   C8 3E   A        STA    MODOP,U
01593A 12A6 6D   C8 28   A        TST    FULLMD,U
01594A 12A9 26   0F   12BA        BNE    MOD165
01595A 12AB A6   01      A        LDA    1,X
01596A 12AD 5F                    CLRB
01597A 12AE 44                  MOD164 LSRA
01598A 12AF C9   00      A        ADCB   #0
01599A 12B1 4D                    TSTA
01600A 12B2 26   FA   12AE        BNE    MOD164
01601A 12B4 C1   04      A        CMPB   #4
01602A 12B6 1022 0094 134E        LBHI   MODE21
01603A 12BA A6   01      A MOD165 LDA    1,X
01604A 12BC 27   32   12F0        BEQ    MODERR
01605A 12BE 30   8D 0112          LEAX   RLISTA-2,PCR
01606A 12C2 30   02      A MOD161 LEAX   2,X
01607A 12C4 44                    LSRA
01608A 12C5 24   FB   12C2        BCC    MOD161
01609A 12C7 34   16      A        PSHS   D,X
01610A 12C9 EC   84      A        LDD    X
01611A 12CB 30   8B      A        LEAX   D,X
01612A 12CD A6   84      A        LDA    0,X
01613A 12CF 81   53      A        CMPA   #'S
01614A 12D1 26   09   12DC        BNE    MOD162
01615A 12D3 6D   C8 3E   A        TST    MODOP,U
01616A 12D6 26   04   12DC        BNE    MOD162
01617A 12D8 30   8D 011A          LEAX   REGUM,PCR
01618A 12DC 17   FF03 11E2 MOD162 LBSR   PDATA
01619A 12DF 35   16      A        PULS   X,D
01620A 12E1 4D                    TSTA
01621A 12E2 27   0B   12EF        BEQ    MOD163
01622A 12E4 1F   89      A        TFR    A,B
01623A 12E6 86   2C      A        LDA    #',
01624A 12E8 17   FEAA 1195        LBSR   OUTEE
01625A 12EB 1F   98      A        TFR    B,A
01626A 12ED 20   D3   12C2        BRA    MOD161
01627A 12EF 39                  MOD163 RTS
01628                           *
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01629A 12F0 8D   5C   134E MODERR BSR    MODE21   DEFAULT TO IMM
01630A 12F2 30   8D 00BD        LEAX   NOTMS,PCR NOT FLAGGED MESSAGE
01631A 12F6 16   FEE9 11E2      LBRA   PDATA
01632                      *
01633A 12F9 AE   4B      A MODE17 LDX    PAC,U    TFR/EXG
01634A 12FB A6   01      A        LDA    1,X
01635A 12FD 2A   02   1301       BPL    MOD171
01636A 12FF 88   08      A       EORA   #$8
01637A 1301 85   08      A MOD171 BITA   #8
01638A 1303 26   EB   12F0       BNE    MODERR
01639A 1305 A6   01      A       LDA    1,X
01640A 1307 47                   ASRA
01641A 1308 47                   ASRA
01642A 1309 47                   ASRA
01643A 130A 47                   ASRA
01644A 130B 8D   08   1315       BSR    PREGT
01645A 130D 17   FEC0 11D0       LBSR   OUTCHR
01646A 1310      2C      A       FCB    ',
01647A 1311 AE   4B      A       LDX    PAC,U
01648A 1313 A6   01      A       LDA    1,X
01649A 1315 84   0F      A PREGT  ANDA   #$F
01650A 1317 81   0B      A       CMPA   #$B
01651A 1319 22   D5   12F0       BHI    MODERR
01652A 131B 30   8D 009D        LEAX   RLISTB-2,PCR
01653A 131F 30   02      A MOD172 LEAX   2,X
01654A 1321 4A                   DECA
01655A 1322 2A   FB   131F       BPL    MOD172
01656A 1324 EC   84      A       LDD    X
01657A 1326 27   C8   12F0       BEQ    MODERR
01658A 1328 30   8B      A       LEAX   D,X
01659A 132A 16   FEB5 11E2       LBRA   PDATA
01660                      *
01661A 132D 17   FEA0 11D0 MODE18 LBSR   OUTCHR  DIRECT PAGE
01662A 1330      3C      A       FCB    '<
01663A 1331 AE   4B      A       LDX    PAC,U
01664A 1333 E6   01      A       LDB    1,X
01665A 1335 4F                   CLRA
01666A 1336 16   FBD3 0F0C       LBRA   REFERN
01667                      *
01668A 1339 AE   4B      A MODE19 LDX    PAC,U    RELATIVE
01669A 133B E6   01      A       LDB    1,X
01670A 133D 1D                   SEX
01671A 133E E3   4F      A MOD191 ADDD   REALPC,U
01672A 1340 EB   C8 1B   A       ADDB   LENGTH,U
01673A 1343 89   00      A       ADCA   #0
01674A 1345 16   FBC4 0F0C       LBRA   REFERN
01675                      *
01676A 1348 AE   4B      A MODE20 LDX    PAC,U    16-BIT RELATIVE
01677A 134A EC   01      A       LDD    1,X
01678A 134C 20   F0   133E       BRA    MOD191
01679                      *
01680A 134E 17   FE7F 11D0 MODE21 LBSR   OUTCHR  IMMEDIATE
01681A 1351      23      A       FCB    '#
01682A 1352 AE   4B      A       LDX    PAC,U
01683A 1354 A6   01      A       LDA    1,X
01684A 1356 2B   05   135D       BMI    MOD212
01685A 1358 17   FCFE 1059       LBSR   OUTSM
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01686A 135B 20   03   1360        BRA    MOD213
01687A 135D 17   FDOE 106E MOD212 LBSR   OUTSM2
01688A 1360 AE   4B      A MOD213 LDX    PAC,U
01689A 1362 A6   01      A        LDA    1,X
01690A 1364 81   20      A        CMPA   #$20
01691A 1366 2D   16   137E        BLT    RTS
01692A 1368 81   7F      A        CMPA   #$7F
01693A 136A 27   12   137E        BEQ    RTS
01694A 136C 17   FE24 1193        LBSR   OUTSP
01695A 136F 17   FE5E 11D0        LBSR   OUTCHR
01696A 1372      22      A        FCB    '"
01697A 1373 AE   4B      A        LDX    PAC,U
01698A 1375 A6   01      A        LDA    1,X
01699A 1377 17   FE1B 1195        LBSR   OUTEE
01700A 137A 17   FE53 11D0        LBSR   OUTCHR
01701A 137D      22      A        FCB    '"
01702A 137E 39             RTS    RTS
01703                      *
01704A 137F AE   4B      A MODE22 LDX    PAC,U     EXTENDED
01705A 1381 EC   01      A        LDD    1,X
01706A 1383 16   FB86 0F0C        LBRA   REFERN
01707                      *
01708A 1386 17   FE47 11D0 MODE23 LBSR   OUTCHR   16-BIT IMM
01709A 1389      23      A        FCB    '#
01710A 138A 20   F3   137F        BRA    MODE22
01711                      *
01712                      *  NON-INSTRUCTION ADDRESSING MODES
01713                      *
01714
01715A 138C AE   4D      A MODE24 LDX    PRC,U     NORMAL FCB
01716A 138E A6   84      A        LDA    X
01717A 1390 17   FCDB 106E        LBSR   OUTSM2    $xx
01718A 1393 84   7F      A        ANDA   #$7F
01719A 1395 27   E7   137E        BEQ    RTS
01720A 1397 81   20      A        CMPA   #$20
01721A 1399 23   E3   137E        BLS    RTS
01722A 139B 34   02      A        PSHS   A
01723A 139D 17   FDEB 118B        LBSR   OUTSP2
01724A 13A0 35   02      A        PULS   A
01725A 13A2 16   FDF0 1195        LBRA   OUTEE
01726                      *
01727A 13A5 AE   4D      A MODE25 LDX    PRC,U     ERROR FCB
01728A 13A7 A6   84      A        LDA    X
01729A 13A9 17   FCC2 106E        LBSR   OUTSM2
01730A 13AC 30   8D 0003          LEAX   NOTMS,PCR
01731A 13B0 16   FE2F 11E2        LBRA   PDATA
01732A 13B3      20      A NOTMS  FCC    / <</
01733A 13B6      00      A        FCB    0
01734                      *
01735A 13B7 AE   4D      A MODE26 LDX    PRC,U     ADDRESS TABLE MODE
01736A 13B9 EC   84      A        LDD    0,X
01737A 13BB 16   FB4E 0F0C        LBRA   REFERN
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01739                                   *
01740                                   *  TABLES
01741                                   *
01742A 13BE      003A     A RLISTB FDB     REGDM-*
01743A 13C0      0030     A        FDB     REGXM-*
01744A 13C2      0030     A        FDB     REGYM-*
01745A 13C4      0032     A        FDB     REGUM-*
01746A 13C6      002E     A        FDB     REGSM-*
01747A 13C8      0032     A        FDB     REGPCM-*
01748A 13CA      0000     A        FDB     0
01749A 13CC      0000     A        FDB     0
01750A 13CE      001E     A        FDB     REGAM-*
01751A 13D0      001E     A        FDB     REGBM-*
01752A 13D2      0014     A        FDB     CCRM-*
01753A 13D4      0015     A        FDB     DPRM-*
01754                                   *
01755A 13D6      0010     A RLISTA FDB     CCRM-*
01756A 13D8      0014     A        FDB     REGAM-*
01757A 13DA      0014     A        FDB     REGBM-*
01758A 13DC      000D     A        FDB     DPRM-*
01759A 13DE      0012     A        FDB     REGXM-*
01760A 13E0      0012     A        FDB     REGYM-*
01761A 13E2      0012     A        FDB     REGSM-*
01762A 13E4      0016     A        FDB     REGPCM-*
01763                                   *
01764A 13E6      43       A CCRM   FCC     /CC/
01765A 13E8      00       A        FCB     0
01766A 13E9      44       A DPRM   FCC     /DP/
01767A 13EB      00       A        FCB     0
01768A 13EC      41       A REGAM  FCB     'A,0
01769A 13EE      42       A REGBM  FCB     'B,0
01770A 13F0      58       A REGXM  FCB     'X,0
01771A 13F2      59       A REGYM  FCB     'Y,0
01772A 13F4      53       A REGSM  FCB     'S,0
01773A 13F6      55       A REGUM  FCB     'U,0
01774A 13F8      44       A REGDM  FCB     'D,0
01775A 13FA      50       A REGPCM FCB     'P,'C,0
01776
01777                                   *  END OF FIRST FILE
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1776

4
256
7
1792

118
1792
4096
6012

6012
1536
4476
2000
6476